Unit (1) Force and Motion

Chapter (1) Motion in one direction

The motion: It is the change of object's location as time passes according to the location of another object



The type of movement 1-Straight 2- Curving 3- Both of straight and curving.

If the movement's path is straight then we call it moving in a straight line in one direction.

G.R. The movement of train represents the simplest type of motion?

Because the train moves forward or backward but it does not move upward or downward.

To describe and measure the motion *of object we use a physical quantity called Speed*

The two factors necessary for the description of motion

1- **The distance** *that covered by the motion*

2- **The time** *taken by the moving body to cover this distance*

Speed: In our daily life, we describe the movement of some objects around us as fast and some others as slow

Speed it is the distance covered (moved) through a unit time.



Example: *If two cars – red car and white car - move on the same road (path,) red car takes a time (t_1) in covering this path while white car takes time (t_2).*

If the time span (t_1 second) is more than the time span (t_2 second), which of these two cars is faster than the other?

The white car is faster than the red car (G.R.)

Because it take smaller time than the red car to cover the same distance

The faster car covers a longer distance in shorter time(G.R.)

The faster car covers a same distance in shorter time

The faster car covers a longer distance in same time

G.R. the object's speed increases as time decreases to cover the same distance?

Because $V = \frac{d}{t}$ *so the speed is inversely proportional with time*

G. the object's speed increases by increasing the covered distance at constant time?

Because $V = \frac{d}{t}$ *so the speed is directly proportional with distance*

What the meant by

1-A train covers a distance 240 km in two hours

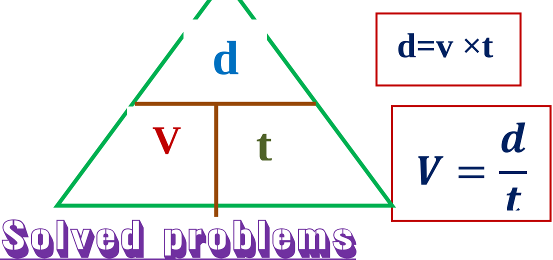
This means that the train moves with speed equals 120 km/h

2- A car moves with speed 100km/h

This means that the car covers a distance 100 km in one hour

3- The speed of a car equals zero

This means that the car is at rest

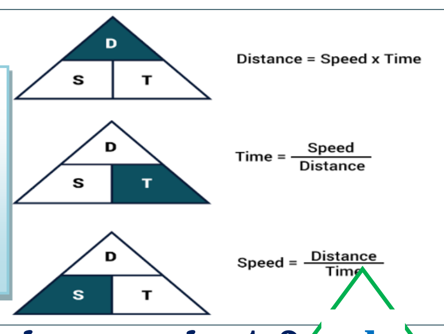


d=v ×t

$V = \frac{d}{t}$

The measuring unit of

- **Time** = Sec, H
- **Distance** = m , km
- **Speed** =m/s , km/h



Solved problems

1- Calculate the speed of runner who runs 240 m in one minute?

Solution $V = \frac{d}{t} = V = \frac{240}{60}$ =4 m/s

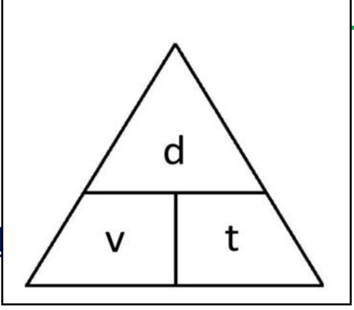
2- Find the distance covered by car its speed 20 m/s the time is 20 s?

Solution d=v ×t =40 d=20 ×20=400 m

3- Calculate the time taken by car its speed 20 m/s the distance is 20 m?

Solution

$t = \frac{d}{v}$ $t = \frac{20}{20}$ =1 s



Unsolved problems (H.W)

1- Calculate the speed of runner who runs 180 m in 3 minute?

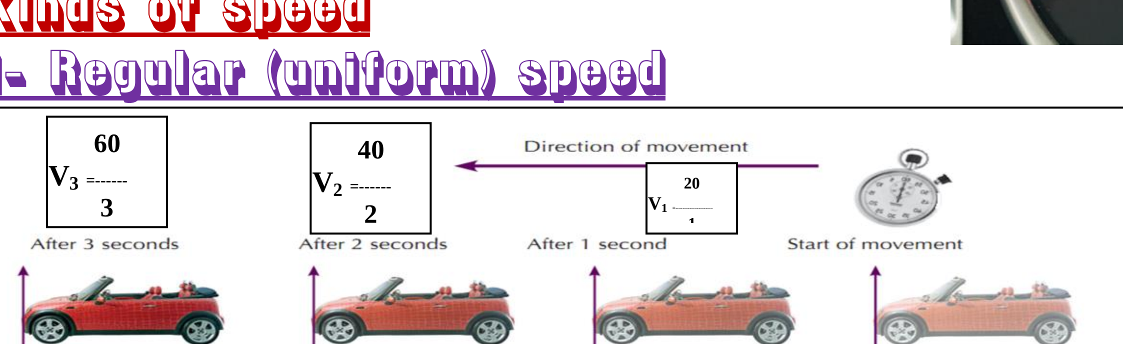
2- Find the distance covered by car its speed 40 m/s the time is 40 seco

Cars and planes *are usually provided with a group of counters as speedometer, mileage, hour timer and compass.*

Speedometer in cars helps us in **identifying the speed** of the car **directly**

Kinds of speed

1- Regular (uniform) speed



$$V = \frac{d}{t}$$

1- Regular (uniform) speed It the change of object's position by **equal** distances at **equal** period of time

The Regular speed *can be calculate from the relation* →

$$V = \frac{\Delta d}{\Delta t}$$

Δd is the distance moved during a period of time Δt

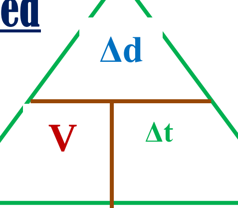
What the meant by

1-An object moves at regular speed 400 km/h?

This means that the object covers 400 kilometer each 1 hour

Solved problems

1- Calculate the distance covered by an object moves at regular speed 240 km/h during 2 hours ?

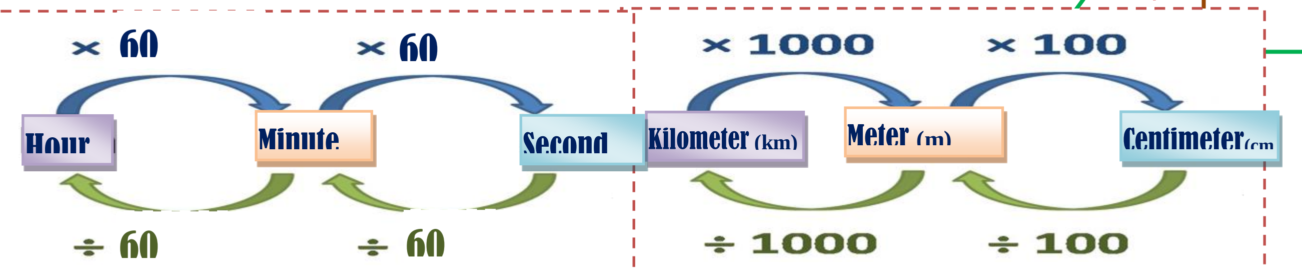


Solution $V = \frac{\Delta d}{\Delta t}$ = $\Delta d = v \times \Delta t$ $= 240 \times 2 = 480$ m

2- Calculate the time needed for body moves at regular speed 50 km/h- to cover distance of 500 km ?

Δd
V Δt

Solution $V = \frac{\Delta d}{\Delta t}$ = $\Delta t = \frac{\Delta d}{V}$: $\Delta t = \frac{500}{50}$ 10 hours



2- Calculate the time needed for body moves at regular speed 40 km/h to cover distance of 400km?

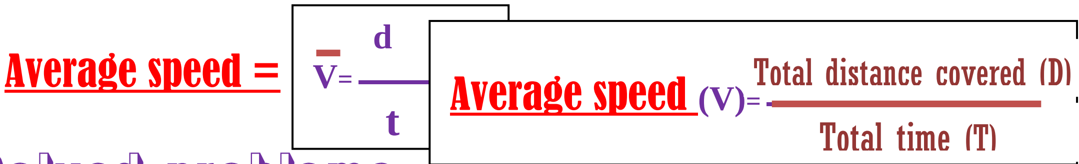
2- Irregular (non-uniform) speed

The change of object's position by unequal distances at equal periods of time.

Or the change of object's position by equal distances at unequal periods of time

Average speed السرعة المتوسطة It is the total distance covered by moving object divided by the total time taken to cover this distance

$$V = \frac{\text{Total distance}}{\text{Total time}}$$



Average speed = $\bar{V} = \frac{d}{t}$

Average speed $(V) = \frac{\text{Total distance covered (D)}}{\text{Total time (T)}}$

Solved problems

1- A racer covered a distance of 100 meters of a straight track in 10 seconds then he returned back waking he took 80 seconds to come back to the starting point of running

Calculate the racer's average speed



a) While running b) while returning c) during the whole trip

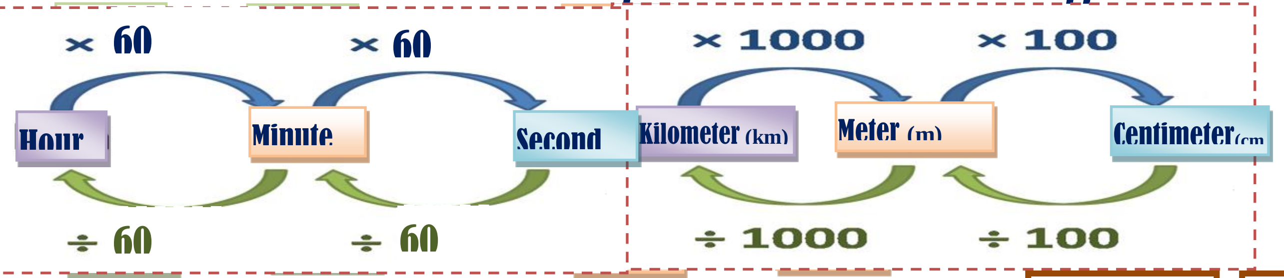
Solution

a) The racer's average speed while running = $V = \frac{d}{t} = \frac{100}{10}$ = 10 m/s

b) The racer's average speed while returning = $V = \frac{d}{t} = \frac{100}{80}$ *1.25 m/s*

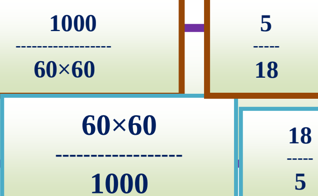
c) The racer's average speed during the whole trip= $V = \frac{d}{t} = \frac{100+100}{10+80}$ = 2.22 m/s

G.R. The most moving cars cannot move inside crowded towns all the time by uniform velocity? *Due to the conditions of the road and the traffic*



To change from km/h to m/s we must divided ÷3.6

To change from m/s to km/h we must multiply ×3.6



$\frac{1000}{60\times60}$ $\frac{5}{18}$

$\frac{60\times60}{1000}$ $\frac{18}{5}$

1- Ahmed drove for 3 hours at rate of 60 kilometer per hour and for 2hours at 80 kilometer per hour(1). Calculate his average speed for the whole journey.

$$V = \frac{d}{t}$$

Solution

Distance =Rate (speed) ×Time d=v ×t

Total distance = (60×3) + (80×2) =340 kilometer

Total time=3+2= 5 hours

The average speed = $V = \frac{d}{t} = V = \frac{340}{5}$ = 68 km/h

$v = \frac{\text{Total d}}{\text{Total t}} = \frac{240+160}{3+2}$ = 68 km/h

What the meant by:- the average speed of a moving car is 40km/h

This means that the total distance covered by the car divided by the total time taken to cover this distance = 40

3-Relative speed

السرعة النسبية It is the speed of moving object relative to an observer

If there is a person in a car that moves at 80 kilometers in a certain direction. Then, a car moves at 90 kilometers passed him in the same direction. This means that if there is a person standing on the side of the road and he observes the speed of the moving cars (this person is called the observer).

Therefore:

1-The speed of the slow car relative to the observer standing on the ground = 80 km /hour

2-The speed of the fast car relative to the observer standing on the ground = 90 km /hour.

3-As for the fast car relative to the passenger in the slow car is 10 km /hour

The amount of the car's speed differ in relative to the change in the observer's position

Relative speed

It is the speed of moving object relative to an observer



Notices.

1- Measuring speeds depends on *the* position of the observer *who determines the magnitude of this speed.*

This means that relative speed is the speed of moving object relative to the observer.

2- We can conclude that: *The value of the car's speed relative to the observer standing on the ground differs from the value of the car's speed relative to an observer in another moving car*

What the meant by

1- The Relative speed of a moving object to an observer equals its real speed?

This means that the *observer is at rest*

2-The Relative speed of an object to moves at 70 km/h to an observer equal 100 km/h?

This means that the observer moves in the opposite direction to the moving object with a speed equals 30 km/h

G.R. The moving car seems stable to an observer moves with the same speed and direction? *Because the relative speed equals zero (V_1-V_2=zero)*

Problem two cars in the same direction, car (A) moves at a speed 30 km/h and a car (B) moves at speed 80 km/h, while a car (C) moves in the opposite direction at speed 40 km/h calculate the relative speed of car (B) to an observer

1- Stands on the ground 2- in car (A) 3- in car (C)

Solution

1- The relative speed of car (B) relative to observer on the ground = 80 km/h

2- The relative speed of car (B) relative observer on car (A) = 80-30=50 km/h

3- The relative speed of car (B) relative to an observer on car (C)=80+40=120 km/h

The observer state	Relative speed
The observer is at rest	*The* relative speed*= The* real *(actual)* speed *of the object*
The observer is moving in the opposite direction of the moving object	*The* relative speed *= The* real speed *of the object* + *The* observer's speed - So *The real speed of the object = The relative speed of the object-The observer's speed*
The observer is moving in the same direction at different speed	*The* relative speed *= The* real speed *of the object* -*The* observer's speed So, *The real speed of the object, of the car = The relative speed of the object + The observer's*
The observer is moving in the same direction at the same speed	*The* relative speed *= The* difference between the two speeds *= Zero.*

Unit one Lesson one

1- Choose the correct answer:

I. The concept of the body movement means ………..

a. constancy of its position with the change in time
b. the change in its position with the time.
c. its speed. d. its acceleration.

2. The two factors which can be used to describe the motion of a body are the

a. speed and time. b. distance and time
c. area and time.. d. displacement and speed.

3. The distance covered by a moving body through a unit time is called the……..of the body.

a. weight b. density c. speed d. motion

4. Speed equals ..

a. distance ÷ time b. distance x time c. distance + time d. time ÷ distance.

5. Speed measurement unit is

a. metre second. b. metre/second c. metre/second ^{2} d. no correct answer..

6. A moving bus covers a distance of 500 m in 25 sec., so its speed equals

a. 200 m/sec b. 20 m/sec^2 c. 20 m/sec. d. 20 m.

7. If a car and a bike moving from the same position and in the same direction, the speed of the car is 50 m/sec, and the speed of the bike is 10 m/sec., after 4 seconds… The distance between them becomes …….. metre.

a. 100 b. 160 c. 200 d. 240

8. The opposite table represents the relation between distance and time of an object moves at a regular speed The value of X equals . em.

Distance (cm)	90	X	180
Time (sec.)	4	6	8

a. 130 b. 135 c. 140 d. 145

9. A train moves at a speed 100 km/h, then it covers a distance of 50 km within time ………. hours.

a. 0.3 b.0.4 c.0.5 d.0.6

10. When a moving object covers equal distances in equal periods of time, this means that the object moves at

a. uniform speed b. uniform acceleration.
c. average speed d. relative speed.

11. A car covers 180 metres in two seconds, so speed equals………..

a. 90 km/h. b. 180 km/h. c. 25 km/h. d. 45 m/sec.

12. If the speedometer of a moving car points to 90 km/h, therefore after two hours the car covers ……….

a. 90 m b. 180 m. c. 90 km d. 180 km.

13. If the uniform speed of a car is 72 km/h, so its speed (in m/sec.) equals

a. 20 m/sec b. 25 m/sec c. 18 m/sec. d. 40 m/sec

14, If a car moves at a uniform speed, where it covers 300 metres in a half minute, then its speed equals. …………metre/second.

a. 300 b. 30 c. 10 d. 150

15. If the uniform speed of a car is 108 kilometres/hour, so its speed equals ….. m/sec,

a. 10 b. 20 c. 30 d. no correct answer

16. A car moves at a regular speed equals 90 km/h, this means that the car covers a distance equals ….. . metres in 40 sec

a. 4000 b. 25 c. 2000 d. 1000

17. When the body covers equal distances at unequal intervals of time, this means that the body moves at ……

a. non-uniform speed. b. increasing acceleration
c. uniform speed. d. decreasing acceleration.

18. In case of motion that is described as movement at an irregular speed, in this case, it is useful to refer to another term which is the ………. speed.

a. uniform b. scalar c. vector d. average

19. A person takes a time of 10 minutes to transfer from home to work moving at an average speed of 3 m/sec. Which of the following equals the distance between home and work ? ………

a. 600 m. b. 1.8 km. c. 60 m. d. 1.2 km.

20. A car moving on a straight line covers a total distance (d) in a total time (t), the average speed of the car is given

b. $V=\frac{d}{t}$ b. $V=d.t$ c. $V=\frac{1}{d}$ d. $V=\frac{h}{km}$

21. A runner ran the 1 100 metres of a race in 8 seconds and the 2nd 100 metres in 12 seconds, therefore his average speed during the whole race is

a. 8 m/sec. b. 10 m/sec. c. 12 m/sec. d. 20 m/sec.

22. The speed of a moving object relative to an observer in another moving object is called

a. uniform. b. irregular c. average speed. d. relative

23.If the relative speed of a car is 50 km/h relative to an observer in a bus moves in the same direction at 70 km/h, therefore the actual speed of this car is ……….

a. 20 km/h. b. 70 km/h. c. 120 km/h d. 170 km/h.

24.If car (A) moves at speed 80 km/h and car (B) moves at speed of 50 km/h in the same direction, the speed of car (A) relative to a passenger in car (B) is …….km/h.

a. 50 b. 80 c. 30 d. 130

25. An observer in a moving car with 80 km/h was observing a moving car with 90 km/h in the same direction, so the observed speed of the second car is…… (Ale 2019)

a. 10 km/h. b. 80 km/h. c. 90 km/h. d. 170 km/h.

26. The relative speed of a moving object relative to an observer moves at the same speed in the opposite direction is ……... the actual speed. (Luxor 2017)

a. double b. the same c. half d. quarter

2. Correct the underlined words :

1. The motion in one direction in a curved line is considered the simplest type of motion.
2. If car (A) took a shorter time than car (B) to cover the same distance, so car (A) was slower than car (B).
3. If car (A) covered a shorter distance than car (B) at the same time span, therefore car (A) was faster than car (B).

4. From speed measuring units are <u>metre/second²</u> or kilometre/hour. **(Suez. Assiut 2019)**
5. The <u>compass</u> helps in identifying the speed of the car directly. **(Minia, Gharbia 2020)**
6. When a moving object covers equal distances at equal periods of time, so it moves with <u>relative</u> speed.
7. <u>The acceleration</u> is the change of the distance through a unit time. **(Cairo 2018)**
8. When the object covers the double of distance at the same time, so its speed decreases <u>to quarter.</u> **(Luxor 2018)**
9.A car moves at a regular speed equals 20 m/sec, this means that the car covers <u>60 m</u> in the third second.
10. Ahmed takes 10 minutes to transfer from his home to work moving at an average speed 3 m/sec., the distance between home and work <u>equal</u> 3 km. **(Kalyoubia 2020)**
11. A moving car moves at a regular speed covers 500 metres in 25 sec., so its speed is <u>200 m/sec.</u> **(Damietta 2016)**
12. A moving car covers a distance of 200 km through 150 min, so its speed is <u>90</u> km/h. **(Giza 2019)**
13. If the uniform speed of a car is 25 m/sec, this means that its speed equals <u>72</u> km/h **(Beni Suef 2020)**
14. A moving car covers 180 km in two hours, so its speed is <u>50 m/sec.</u> **(Kalyoubia 2015)**
15. A moving car covers 20 metres in one second, so its speed is <u>90 km/h</u> **(Kalyoubia 2016)**
16. <u>Relative speed</u> represents the regular speed by which the moving object moves to cover equal distances at equal periods of time. **(Cairo 2020)**
17. If the value of the speed (V) = $\frac{d_1+d_2+d_3}{t_1+t_2+t_3}$ *this means that this speed is <u>increased</u>.* **(Ismailia. Sharia 2017)**
18. <u>Average speed</u> is the speed of a moving object relative to an observer **(Kalyoubia 2019)**
19. The value of a car speed relative to an observer standing on the ground <u>is the same to</u> an observer in another moving car.
20. <u>Relative speed</u> equals the total distance covered by the moving object divided by the total time taken to cover this distance. **(Red Sea 2015)**
21. Measuring the relative speed of a moving car depends on <u>the time</u>. **(Red Sea 2020)**
22. If two cars moving in the same direction at the same speed equals 100 m/sec. so the relative speed equals <u>200 m/sec</u>. **(Beni Suef 2018)**
23. The relative speed of two moving bodies in the same direction equals <u>the sum of</u> their speeds. **(Menofia 2016. 2018)**
24. The moving car with a certain speed seems to be at <u>high speed</u> to the moving observer at the same speed and the same direction. . **(Menofia 2017)**
25. The relative speed of a moving car relative to an observer at rest is <u>less than</u> the real speed. **(Giza 2018 Kalyoubia 2020)**

3. Write the scientific term of each of the following :

1. • The change in the position of an object by the time passes relative (according) to the position of another fixed object. (Cairo, suez 2020)
 • The change of an object position as time passes according to a fixed position. (Kalyoubia 2018)
2. • The distance that a moving object covers within a unit time. (New Valley 2017)
 • The distance moved through a unit time. (Cairo 2019)
 • The result of dividing the distance over time.
3. • The result of multiplying the speed of a body by the time. (Menia 2018)
 • The result of multiplying half the speed of a body by double of the time(Luxor 2019)
4. The measuring unit of speed.
5. An instrument used in cars and planes to identify speed directly.
6. A moving object covers equal distances at equal periods of time. (Giza 2014)
7. The speed by which the object moves to cover equal distances at equal periods of time. (Behira 2018 / Beni Suef 2020)
8. The thing which moves at constant speed in the space. (Kalyoubia 2014-Red Sea 2016)
9. The speed of a moving body that covers equal distances at unequal time span, (Kalyoubia 2019-Fayoum 2020)
10. • The total distance that a moving object covers divided by the total time taken to cover this distance. (Assiut -Suez 2020))
 • The regular speed by which the moving object moves to cover the same distance at the same period of time. ((Behira – Dakahha 2019)
11. • The speed of a moving object relative to the observer. (Alex. Beni Suef. Willey 2020)
 • The value of an object speed relative to the observer. (Ismailia, -South Sinai 2019)
 •The speed of a moving object relative to a constant (fixed) or a moving observer. (Sharkia, Sohag 2019)

4. Give reasons for :

1. The motion of a train (or metro) can be considered from examples of motion in one direction. (Dukahlia 2018 North Sinai 2020)
2. • Cars and planes are provided with speedometers.
 • The importance of speedometer in cars and planes. (Menofia. Port Said 2018)
3. The object speed increases by decreasing the time needed to cover a certain distance. (Aswan 2017/Dakahlia 2020)
4. The speed of a moving object increases as the covered distance increases at a constant time.
5. Car (A) which covers 50 metres in 5 seconds is faster than car (B) which covers 64 metres in 8 seconds.
6. Most of moving cars cannot move inside crowded towns all the time by uniform speed.
7. • The Metro moves at an irregular speed. (Red Sea 2014)
 • The train moves at an irregular speed.

8. The relative speed of a moving object in a certain direction differs according to the difference of the observer state.
9. A moving observer can't accurately determine the actual speed of a moving object. 10. A moving car seems stable (at rest) to an observer moves at the same speed and the same direction (Aswan Gharbia 2020)
11. The relative speed of car relative to a moving observer equals zero (Giza2020).

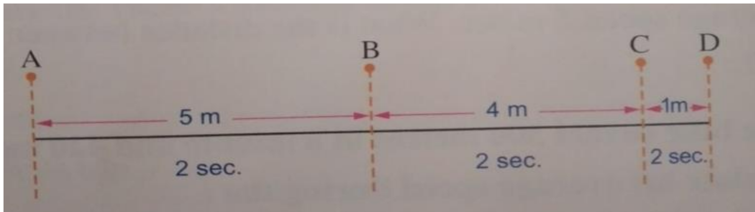
5. What is meant by each of the following ...?

1. The change of an object location as time passes. (Gharbia 2012)
2. An object moving in a straight line, covers a distance of 20 metres in one second (North Sinai 2015)
3. A moving car covers a distance of 100 km in two hours (Giza. North Sinai 2019)
4. A car covers equal distances at equal periods of time. (Beni Suef 2015).
5. The distance covered by an object is changed by 2 metres each second. (Luxor 2019)
6. The distance covered by an object is changed by 15 m each 3 seconds. (Luxor 2018)
7. The speed of a moving object equals 100 km/h (Sheikh 2018)
8. A body moves at a uniform speed equals 5 m/sec. (Menia 2018)
9. The speed of a body equals zero (Port Said 2018.
10. A car moving at a uniform speed equals 80 km/h. (Qena, Part Said 2019)
11. A moving car covers equal distances at unequal periods of time.
12. The average speed of a moving car is 70 km/h. (Port Said, Beni Suef 2019)
13. The average speed of a moving car is 60 km/h. (Gharbia 2017)
14. The relative speed of a car related to a moving observer equals zero. (Matrouh 2017)
15. The relative speed of a train equals 90 km/h. (Giza 2014 Kalyoubia 2015)
16. The relative speed of a moving car equals 70 km/h relative to an observer which moves in the opposite direction at a speed of 20 km/h.

6. Problems :

1. A runner covers 450 metres in 45 seconds, Find his speed.
2. A train travels from Cairo to Alexandria a distance of 250 km in 2 hours. Find its speed.
3. A train covers 50 m in two seconds. Find its speed in km/h. Sharkia 2016 Giza 2017)
4. A train starts to move at 7 o'clock in the morning, then what is the time of arrival if it moves at speed of 100 km/h to cover the distance of 500 km. (Damietta 2017-2020)
5. A bus covers a distance of 120 km at a speed of 90 km/h, then it covers 105 km at 70 km/h. Calculate the time needed to cover the whole distance.
6. A car moving at a uniform speed equals 80 km/h. Find its speed in m/see.
7. One of the foxes attacked a deer at rest. If the average speed of the fox is 120 km/h, calculate the distance (by km and metres) covered by the fox to catch the deer if the time taken is 10 sec.
8. A body moves at a regular speed (m/sec.) according to the following mathematical equation $d = 6\ t$. Find: (a) The speed of this body. (b) The time needed to cover 360 m.

9. Study the following figure, then answer the following:



A body moves from starting point (A) to ending point (D) as the shown distances and times in figure.

-Does this body move at regular or irregular speed ? Why ?

10. If Ahmed walked at speed 1.5 m/sec. for 30 sec. and Ali walked at speed2 m/sec. for 15 sec. then walked at another speed 1 m/sec. for 15 sec. *Which one of them has the larger average speed?*

11. Calculate the average speed *of a car that move in a circular path whose length is 300 m for 10 rounds in 3 mutes.* *(Menia 2013)*

12. A moving object covers a distance of 20 m through 4 sec then it covers 40 m through 11 *sec.* **Calculate** *the average speed of the object* *(Behira 2014-Fayoum20.17)*

13. A moving car (A) in a straight line measures the relative speed of a car (B) which was moving in the opposite direction, it found that the relative speed of the car (B) was 140 km/h and when the car (A) *reduces its speed to half, it found that the relative speed of the car (B) becomes 100 km/h.*

Calculate *the real speed of the two cars.* *(Luxor 2019)*

14. A body moves in a straight line and the distance covered in different times *is recorded in the opposite table.*

Distance (m)	*10*	*20*	*30*	*4*
Time (sec.)	*5*	*10*	*15*	*20*

(a) **Calculate** *the body speed.*

(b) **What** *is the type of the speed?* *(Damietta 2012)*

15. A body moves in a straight line *at a regular speed and the distance covered in different times is recorded in the opposite table.*

Distance (m)	*2*	*8*	*12*	*X*	*20*
Time (sec.)	*2*	*4*	*8*	*15*	*20*

(a) **Calculate** *the speed of the body.*

(b) **What** *is the value of (X) and (Y)?*

16. A body covers a distance of 20 km through 4 minutes, *then it covers 40 km through 12 minutes.* **Calculate** *the average speed of the body.* *(Sohag North Sinai 20181)*

17. A student on a bike takes a time of 15 minutes to transfer from his home *to his school moving by average speed 5 m/sec.* **What is the distance between his** *home and his school in km ?* *(Port Said 2016)*

18. A boy on a bike *covers 300 metres in a minute and 420 metres in the following minute.* **Calculate** *his average speed during the :*

(a) First minute,

(b) Second minute.

(c) Two minutes together. *(Aswan 2018)*

19. Two cars move in a straight line, car (A) moves at 20 m/sec, while car (B) moves at 25 m/sec. Calculate:

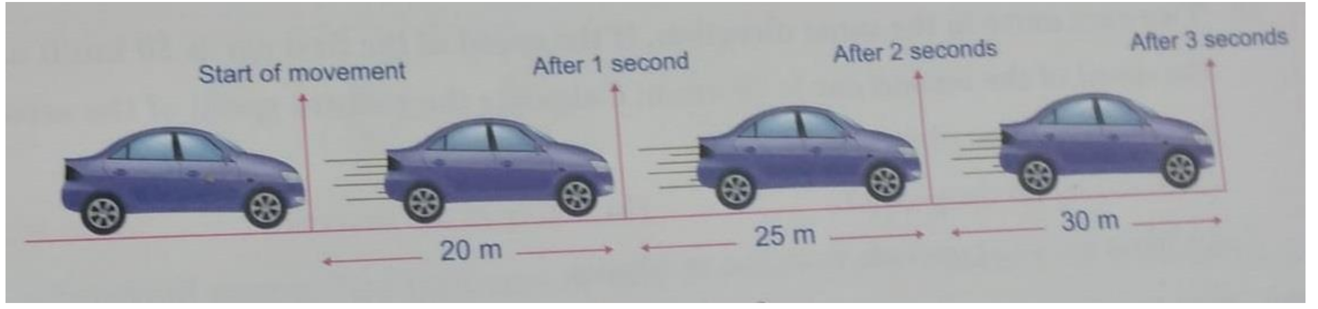
(a) The distance covered by each car after one minute.

(b) The time taken by each car to cover a distance of 100 m ***(Suez 2011)***

20.A student takes a time of 15 minutes to reach his school, when he moves at an average speed (2 m/sec. **Calculate** *the total distance covered by the student, when he goes to school and returns back again to his starting point.* ***(Kalyoubia 2018)***

21. A racer ends the race in 2 hours with average speed 25 km/h, *If you know that the racer covers the first 15 km in an hour* **Calculate** *the speed of the racer after the first hour to complete the race in the given time.* ***(Behira 2018)***

22. Study the following figure, then answer the following :



(a) **Does** *the car move at a regular speed ? Why ?*

(b) **Calculate** *the car speed during the: 1. First second. 2. Third second*

(c) **What** *is the average speed of the car during the three seconds together ?*

23. A moving body covers a distance equals 80 metres in 2 seconds, *then covers a distance equals 120 metres in 3 seconds.* **Does** *such body move at a regular speed ? Why ?* ***(Giza 2016)***

24. A racer covered a distance of 50 metres of a straight track in 5 seconds, *then he returned back walking, he took 20 seconds to come back to the starting point of running.* **Calculate the racer's average speed :**

(a) While running. *(b) While returning.*

(c) During the whole trip. ***(Gharbia 2018/ Giza 2020)***

التمثيل البيانى حركة فى خط مستقيم

Chapter (2)

Graphic representation of moving in a straight line

(G.R) physicists use mathematical methods like graphics and tables

To 1- predict the relation between physical quantities

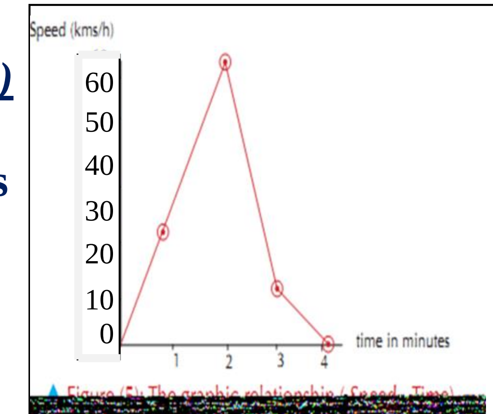
2- Understand practical results

3- Describe physical phenomena in an easier way.

Graphics *can possibly represent the relation between speed and time in a moving car.*

If the car starts moving from rest (speed = zero) And after one minute its speed becomes 30 km/h. After another minute, its speed increases to 60 km/h.

Then, the motorist had to use the brakes to slow down the car's speed to 20 km/hour in the third minute and he stops completely after another minute.



It is possible to represent the movement graphically

1-Regular speed

Activity To discover: representing uniform speed graphically

Tools: *A toy car operated by a battery - a smooth wooden board of about 3 meters - a metric ruler or a metric strip - a stop watch*



Figure (6) the relation between distance and time

Procedures: الإجراءات

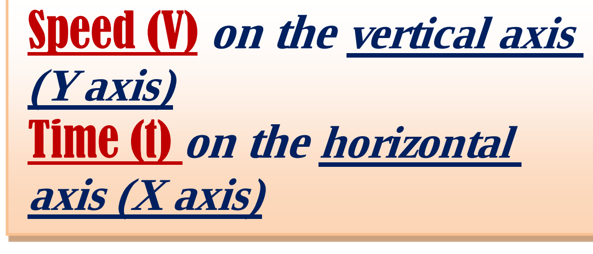
1- Place the wooden board at a horizontal position. Put two marks at a known distance on the wooden board Measure the distance between them (d)

2- Operate the car, and during that, calculates the time (t) necessary to cover this distance.

3- Repeats the experiment changing the two marks.

4- Exchange tools and repeats the experiment.

5- Write the results in a table.
6-In each time, calculate the speed of the car from the relation: V= d/t.
The following table illustrates some readings that a group of students made:

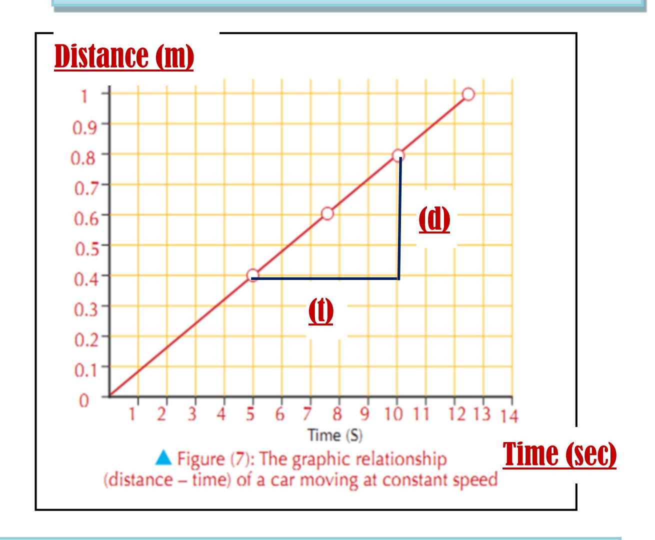


Time of trial	Covered distance (d) meter	Time covering distance (t) second	Speed V = d/t M/S
1	0.4	5	0.08
2	0.6	7.5	0.08
3	0.8	10	0.08
4	1.0	12.5	0.08

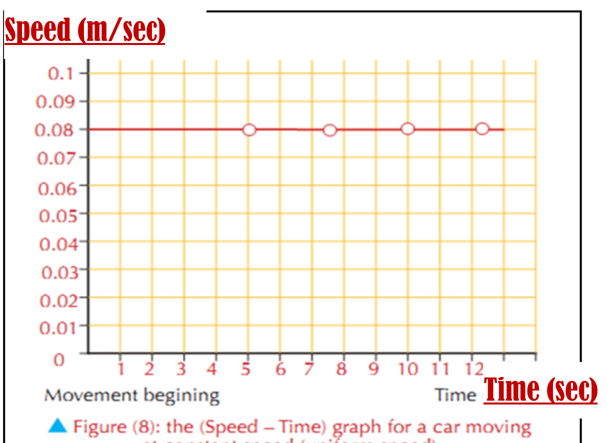
To illustrate the relation between distance (d) and time (t)

Distance (d) *on the vertical axis (Y axis)*
Time (t) *on the horizontal axis (X axis)*

Speed (V) *on the vertical axis (Y axis)*
Time (t) *on the horizontal axis (X axis)*



▲ Figure (7): The graphic relationship (distance – time) of a car moving at constant speed



▲ Figure (8): the (Speed – Time) graph for a car moving at constant speed (uniform speed)

The relation (Distance – Time)

As

A straight line passing the intersection point of the two axes. (The origin point) **(G.R?)**

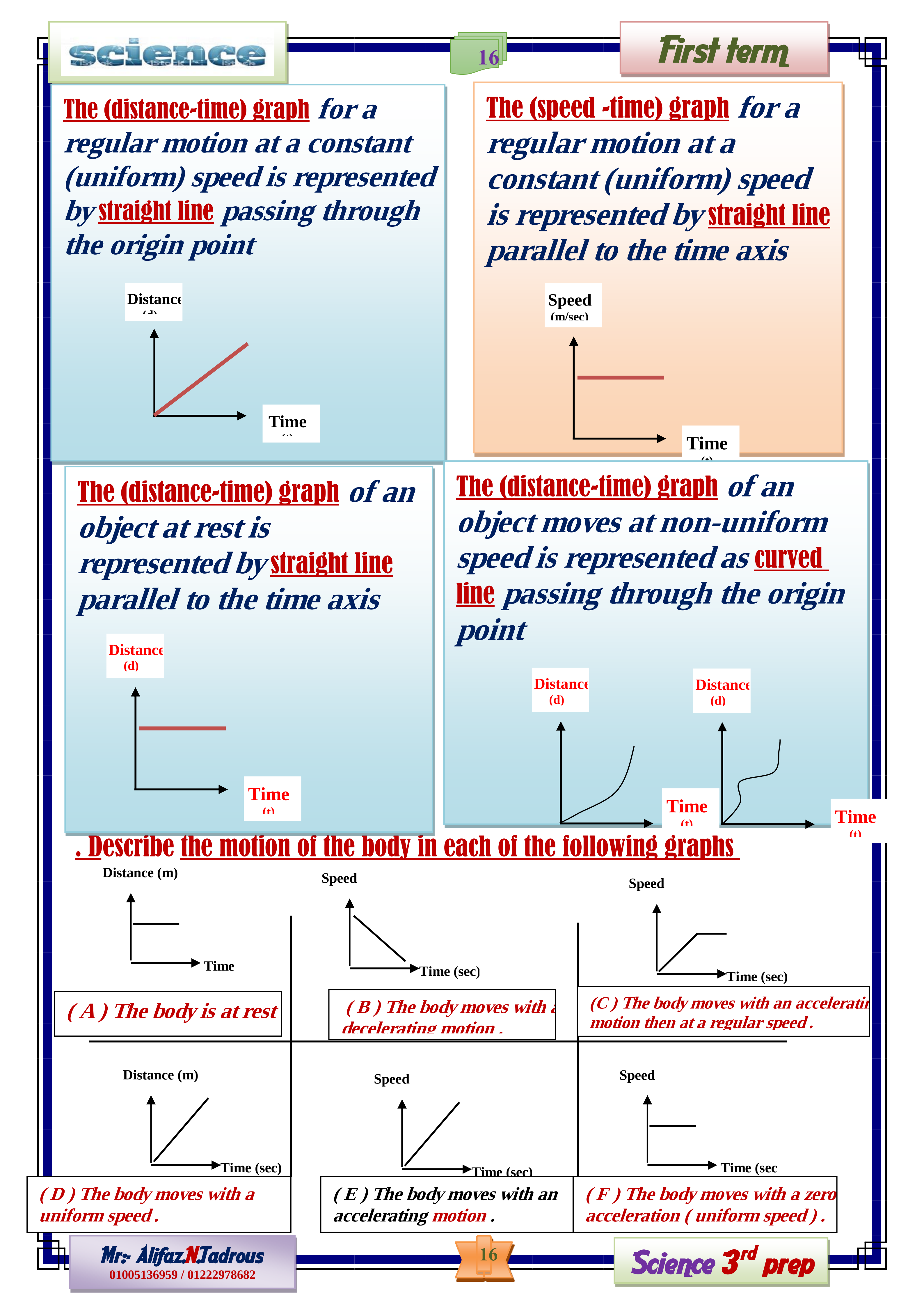
Because the **distance** *(d) is* **directly proportional** *to the* **time** *(t) because the object moves with regular speed*

The relation (Speed – Time)

As

straight line parallel to the time axis) **(G.R?)**

Because the **speed** *of object remains* **constant** *as time passes*



The (distance-time) graph *for a regular motion at a constant (uniform) speed is represented by* **straight line** *passing through the origin point*

The (speed -time) graph *for a regular motion at a constant (uniform) speed is represented by* **straight line** *parallel to the time axis*

The (distance-time) graph *of an object at rest is represented by* **straight line** *parallel to the time axis*

The (distance-time) graph *of an object moves at non-uniform speed is represented as* **curved line** *passing through the origin point*

. Describe the motion of the body in each of the following graphs

(A) The body is at rest

(B) The body moves with a decelerating motion .

(C) The body moves with an acceleration motion then at a regular speed .

(D) The body moves with a uniform speed .

(E) The body moves with an accelerating motion .

(F) The body moves with a zero acceleration (uniform speed) .

Acceleration عجلة It is the change of an object's speed in one second in a specific direction

Unit of time

the concept of acceleration

$$Acceleration\ (a) = \frac{Final\ speed\ (V2) - initial\ speed\ (V1)}{Time\ (\Delta t)}$$

m/s^2
meters / second^2

The measurement units of acceleration

The speed units are meters/second - The time unit is second.

∴ *Acceleration units = meters/second ^{2} = m/s^2*

$$\text{Acceleration units} = \frac{\text{Speed units(m/sec)}}{\text{Time units (sec)}} = \frac{\text{Meters}}{\text{Second}\ \text{Second}}$$

Acceleration units = meters/second ^{2} = m/s^2

Problems:

①-A special car can move from rest and its speed reaches 90 m/s in 10 seconds. What is the acceleration with which the car moved?

Solution

Acceleration of the car = $\frac{V_2 - V_1}{t}$ = $\frac{90-0}{10}$ = 9 m/sec^2

(Triangle: $V_2 - V_1$ / A | t)

②-- A car moves at speed 40 m/s, then the driver use the break to stop the car through 20 seconds. Calculate the acceleration which the car moves.

Solution

Acceleration of the car = $\frac{V_2 - V_1}{t}$ = $\frac{0-40}{20}$ = -5 m/s^2 *Negative acceleration*

③-If an object moves from rest regularly until its speed reaches 10 meters/ second after two seconds from the start of moving, Calculate

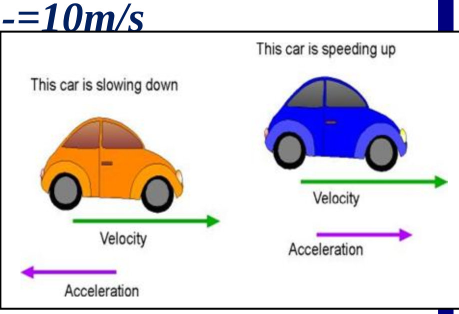
Solution

(Triangle: $V_2 - V_1$ / A | t)

a -The change of speed through two seconds = $\frac{10-0}{2}$ = 5m/s

b -The change of speed through one second = $\frac{10-0}{1}$ = 10m/s

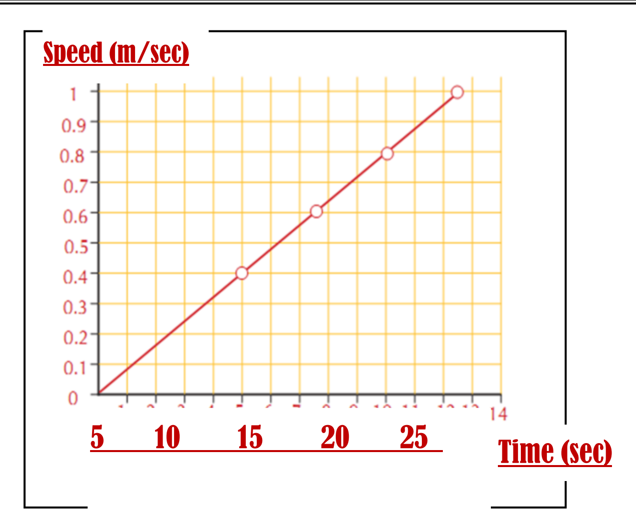
c -Acceleration = $\frac{10-0}{2}$ *m/s^2*

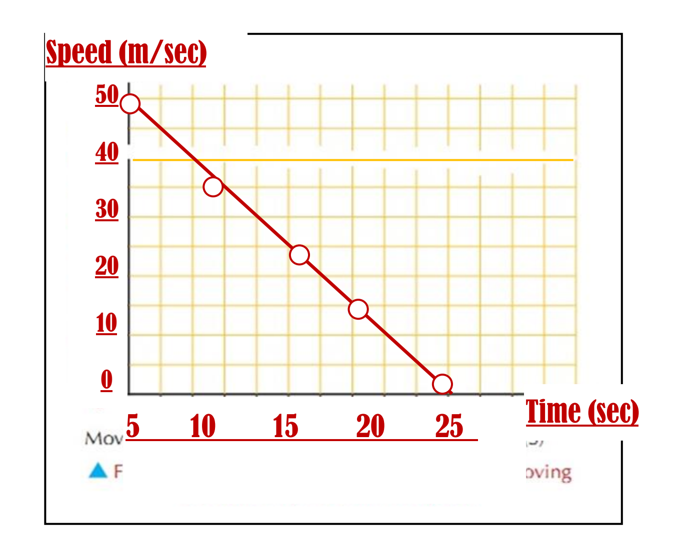


Whose movement starts from rest and then its speed increases to 12 thought 3 seconds

Acceleration is= $\frac{V_1 - V_2}{t}$ = $\frac{12-0}{3}$ = 4 m / sec^2

Positive acceleration increases (Acceleration motion) تزايدية	Negative acceleration decreases (Deceleration motion) تناقصية
The object's speed increases by equal values through equal time. *Its end final speed is greater than its start (initial) speed*	*The object's speed decreases by equal values through equal time.* *Its start (initial) speed is greater than its end final speed*





What the meant by

1- An object moves with positive acceleration =5m/sec²?

This means that the object's speed increase by 5m/sec each one second

2-Abody moves with negative acceleration =-2m/sec²?

This means that the object's speed decrease by 2m/sec each one second

2-Abody moves with zero acceleration?

This means that the object's speed constant

End final speed is = than its start (initial) speed

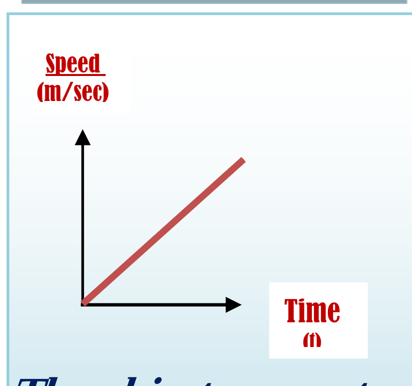
Zero acceleration

Speed (m/sec)

Time (t)

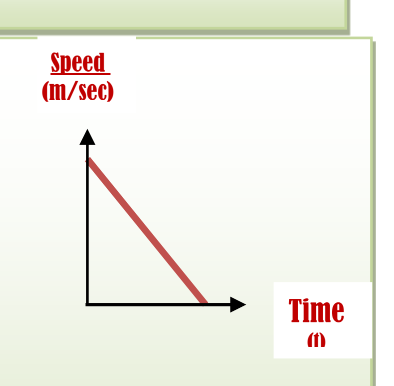
The object move at
(a uniform speed)
V (initial)= V (final)

Positive acceleration



The object move at
(a non- uniform speed)
V (initial) < V (final)
So, it moves at an acceleration motion

Negative acceleration



The object move at
(a non- uniform speed)
V (initial) > V (final)
So, it moves at a Deceleration motion

Uniform acceleration

An object starts its movement from rest and in a straight line

Its speed record each 5 seconds

Time (t) second	0	5	10	15	20	25	30
Speed (V) meters/second	0	10	20	30	40	50	60

Observation The object's speed increase during movement

The object's speed increase by 10 m/s every 5 seconds

The object's acceleration in the 1st 5 sec= $\frac{V_2 - V_1}{t} = \frac{10-0}{5} = 2 m/sec^2$

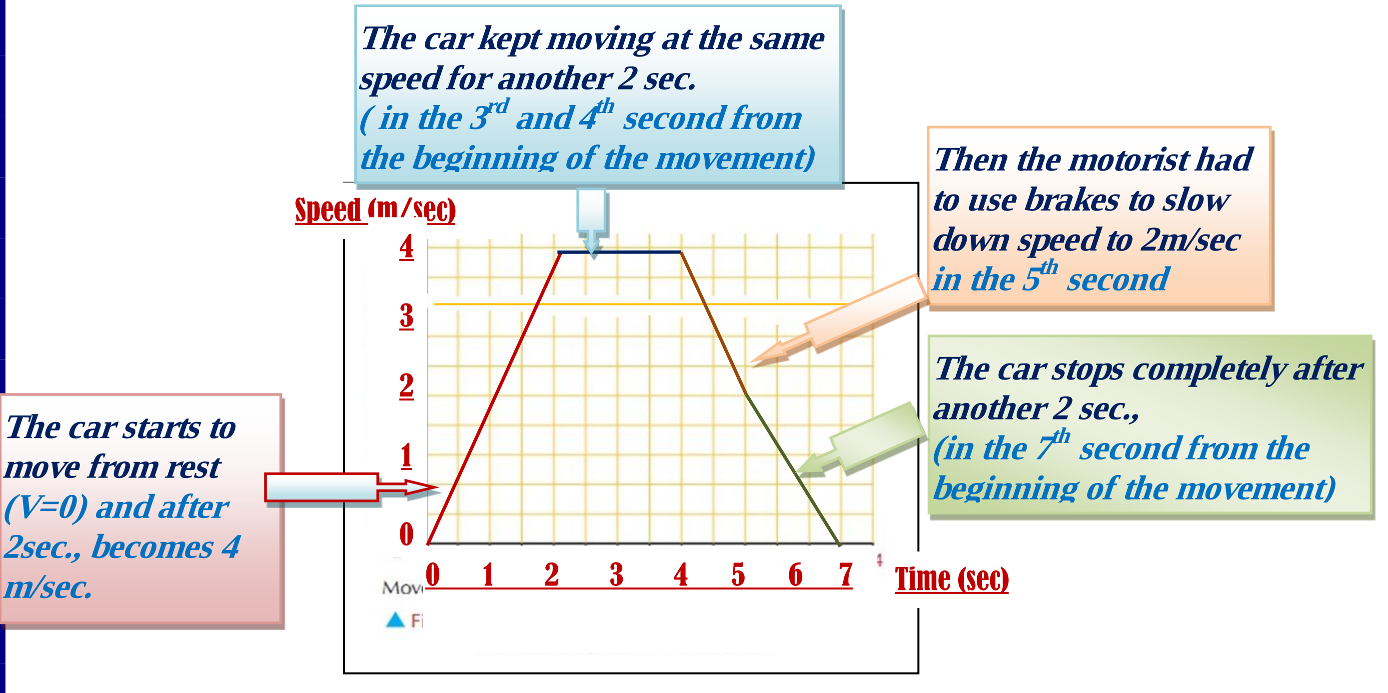
The object's acceleration in the 2nd 5 sec= $\frac{V_2 - V_1}{t} = \frac{20-10}{5} = 2 m/sec^2$

That means acceleration remains constant

problem

1-If a car start to move from rest and after 2 sec. its speed become 4m/s. and it kept moving at the same speed for another 2 sec. then the motorist had to use brakes to slow down speed to 2m/sec. in the fifth second, and it stops completely after another 2 sec., represent the relation graphically

Solution



Unit one Lesson two

1- Choose the correct answer:

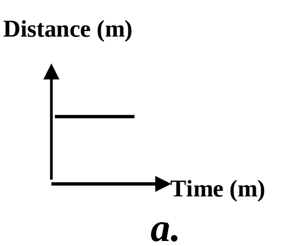
1. (Distance -Time) graph for a regular motion at a constant speed is a ……….

a. straight line parallel to time axis.
b. straight line parallel to the distance axis.
c. straight line passing through the origin point.
d. straight line cuts the time axis and the distance axis.

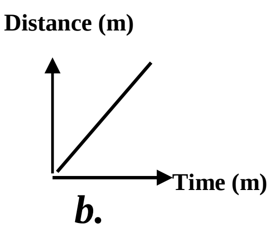
2. For a car moves at a regular speed, the ratio d/t

a. increases b, is constant c. decreases, . d. is doubled

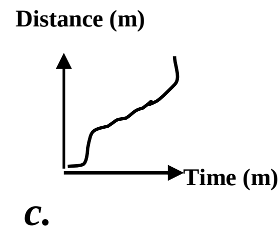
3. Which of the following graphs represents the movement of an object at a constant speed?



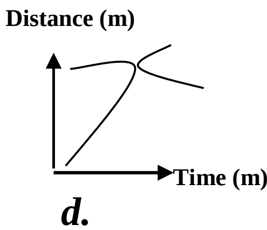
a.



b.

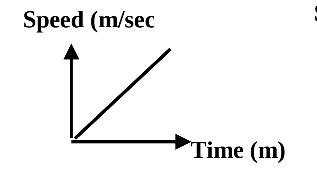


c.

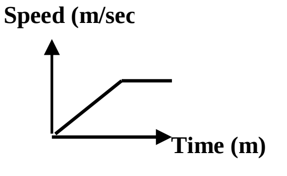


d.

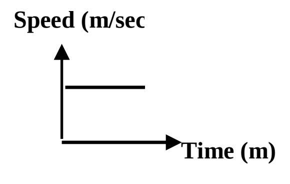
4. The graph (. ………….) represents an object moves with uniform acceleration.



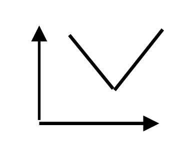
a.



b.

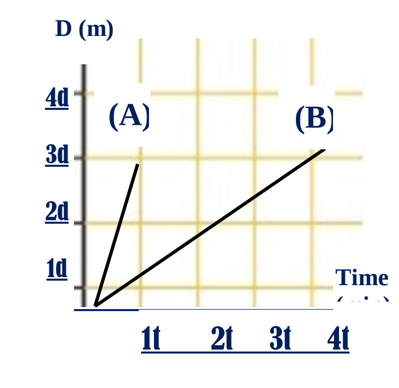


c.



d.

5. In the opposite graph : The ratio between the speed of two objects ($\frac{A}{B}$) approximately is



a. $\frac{9}{2}$ b. $\frac{9}{4}$ c. $\frac{9}{3}$ d. $\frac{3}{2}$

6. From the opposite graph, what is the speed of the car ?..

Distance Km
125
100
75
50
30 45 60 75 Time (min)

a. 25 kilometre per hour.
b. 50 kilometre per hour.
c. 75 kilometre per hour.
d. 100 kilometre per hour.

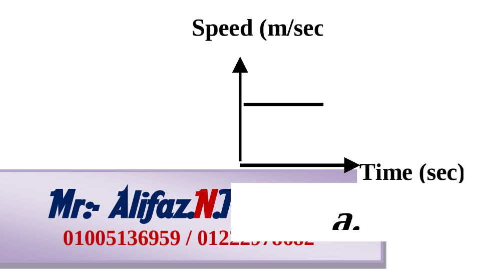
7. On recording the results of an experiment in which an object moves, the results were as follows:
This object moves at…. Time (second)

Distance (m)	10	20	30
Time (sec.)	1	2	3

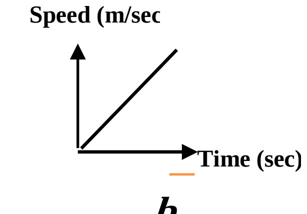
a. an increasing speed. b. a uniform acceleration
c. a uniform speed d. an irregular speed.

(Aswan, Red Sea 2015)

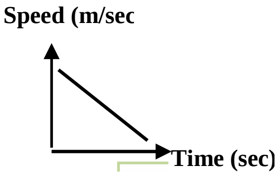
8. Which of the following (speed - time) graphs describes the movement of an object moves at a constant speed ?



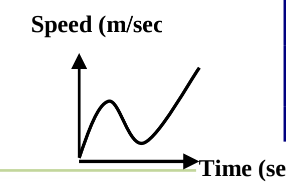
a.



b.



c.



d.

9. If the body moves from rest at a uniform acceleration, so its final speed is determined from the relation

a. $\frac{V1}{V2}$ b. $\frac{d}{\Delta t}$ c. $\frac{a}{\Delta t}$ d. $a \times \Delta t$

10. The uniform acceleration means that the object speed………. by equal values through equal periods of time.

a. increases only *b. decreases only*
c. increases or decreases *d. doesn't change*

11. When an object speed increases, the movement is described as

a. uniform speed. *b. decelerating motion*
c. zero acceleration. *d. accelerating motion.*

12. When an object moves with acceleration = zero, this means : the

a. object's speed is changed. *b. object moves with positive acceleration..*
c. object moves with deceleration, *d. object's speed is constant.* *(Sohag Gharbia 2020)*

13. Decelerating motion means the . ………..

a. object speed decreases by time. *b. object speed increases*
c. object speed is constant. by time. *d. object is at rest.*

14. Acceleration is the . …………..

a. change in distance in a unit time.
b. change in speed in a unit time.
c. rate of change of distance relative to the speed.
d. no correct answer.

15: Acceleration measurement unit is

a. metre /sec *b. metre .sec* *c. metre /sec^2* *d. metre./sec^2*

16. The object moves at a constant uniform speed, this means that….. (Sharkia 2018)

a it moves at zero acceleration. *b. it moves at constant acceleration.*
c. it covers equal distances at unequal time intervals.
d. it covers unequal distances at equal time intervals.

17. A car moves at a speed 30 m/sec., then its speed changes to 60 m/sec, after three seconds so the acceleration at which the car moves is .

a. 10 m/sec *b. 10 m/ sec^2* *c. 20 m/ sec^2* *d. a. 10 m/ sec*

18. If an object at rest constancy moves regularly until its speed reaches 12 m/sec. after three d. 30 m/sec. seconds from starting motion so, the acceleration equals …..m/sec^2 *((Behira 2014)*

a. 36 *b. $\frac{1}{4}$* *c. 4* *d. 9.*

19. If a boat starts to move from rest till its speed becomes 2.5 m/sec. through 0,5 see. so, the acceleration of the moving boat is ………..

a. 25 m/ sec^2 *b. 5 m/ sec^2* *c.0.2 m/ sec^2* *d. 10 m/ sec^2*

20. The ratio between the final speed and the initial speed of an object moves at an accelerating motion is ……….

a. more than one. *b. less than one,* *c. equal to one.* *d. equal to zero*

21. The ratio between the final speed and the initial speed of an object moving in a straight line in a decelerating motion (a negative acceleration) is

a. more than one *b. less than one* *c. equal to one.* *d. equal to zero.*

22. When the final speed of a moving object is less than its initial speed, therefore the object motion is described as .

a. uniform speed. *b. accelerating motion.*
c. decelerating motion. *d. uniform acceleration.*

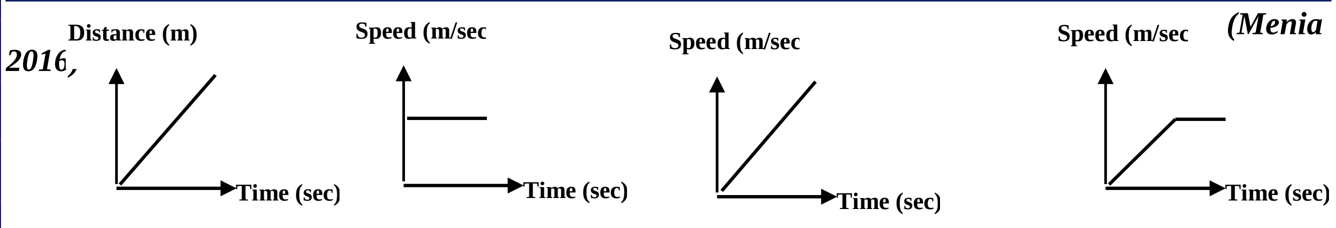
23. Movement is at a uniform acceleration

a. if the object's speed changes at equal values in equal time intervals.
b. if the distance that the object covers changes at equal values in equal time intervals
c. if the average speed equals the regular speed.
d. no correct answer.

24. When a car moves by positive uniform acceleration of (6 m/ sec^2)this means :

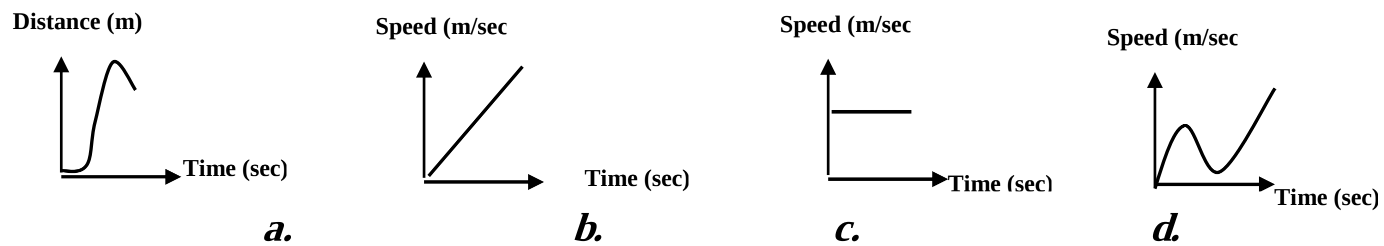
a, The car speed increases by the rate of (6 m/sec) every second.
b. The car speed decreases by the rate of (6 m/sec) every second.
c. The car covers 6 meters each second.
d. The car acceleration increases by the rate of (6 m/ sec$^{2)}$) every second.

25. Which of the following graphs represents the motion of a body at a uniform acceleration *(Menia 2016)*



a. *b.* *c.* *d.*

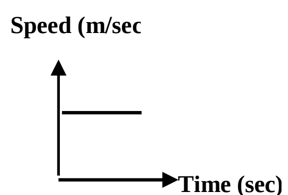
26. The graph………. is the object moves with acceleration equals zero. (Red Sea 2019)



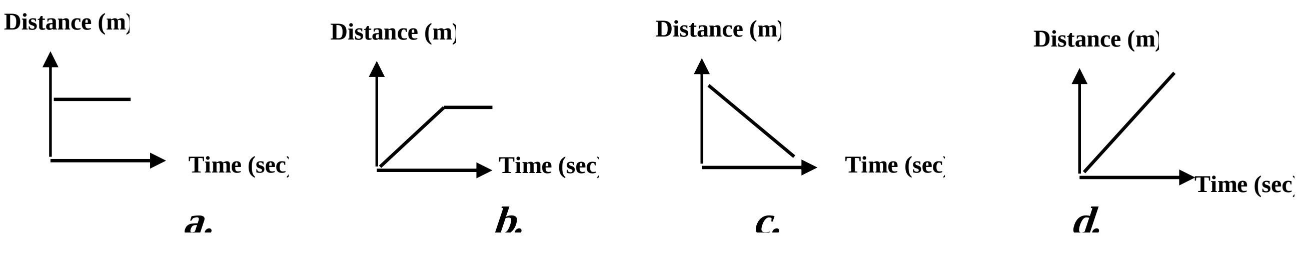
a. *b.* *c.* *d.*

27. A car takes 4 sec, to reach 9 times its initial speed, so the car moves with acceleration which its numeric value equals

a. quarter *b. half* *c, three times* *d. double*



28. The opposite graph represents the relation (speed-time) of a moving object. Which of the following graphs represents the relation (distance - time) of the same moving object …………………



a. *b.* *c.* *d.*

2. Correct the underlined words:

1. To understand many of the physical phenomena, use <u>acceleration</u> between different variables to describe a specific phenomenon. (Sohag 2018)
2. The (distance time) graph of an object moves at a regular speed is represented by a straight line <u>parallel to the (Y) axis.</u> (Sohag 2019)
3. The distance covered by a body moving at a regular speed is <u>inversely</u> proportional to time needed to cover this distance
4 The (speed - time) graph of a moving object at regular speed is represented by a straight line <u>passes by the origin point</u>. (Luxor 2015)
5. The following graph represents a body at rest. (North Sinai 2020)

V (m/sec)
T (sec)

6. Acceleration measuring unit is <u>sec^2/m</u>.
7. The car which begins its movement from rest, moves at <u>uniform speed</u>.
8. When a moving object covers equal distances in equal periods of time, it is said that it is moving at a <u>decreasing</u> acceleration.
9. Displacement is the value of the change of an object speed in one second (South Sinai 2019)
10. Acceleration is <u>constant</u> if the object's speed increases by time. (New Valley 2018)
11. Acceleration (a) = $\frac{\text{Initial speed - Final speed}}{\text{Time } (\Delta t)}$
12, When a body moves at an acceleration- 3 m/sec^2 this means that its initial speed is <u>less</u> than its final speed. (Sharkia 20216)
13. When a boat starts to move from rest till its speed becomes 2.5 m/sec. through 5 sec., this means that it moves with acceleration <u>10 m/sec^2</u>. (Ismailia 2017)
14. The results in the table in front of you represent the experiment of a moving object at <u>decreasing</u> speed.

Distance (m)	10	20	30	40
Time (sec.)	1	2	3	4

15. When an object moves at uniform acceleration. this means that the speed is <u>zero</u>. (Behira 2020)
16. When the driver of a moving car uses the brake to stop it after a period of time. its <u>initial</u> speed becomes equal to zero. (Cairo 2017)

3. Write the scientific term of each of the following :

1. Mathematical methods that physicists use to predict the relation between certain physical quantities. (Fayoum 2018, Beni Suef 2019)
2. • The value (amount) of change in the object speed in one second. (Cairo 2017)
   • The rate of change of speed.
3. The measuring unit of acceleration.
4. The change of the object speed by equal values (increases- decreases) through equal periods of time. (Cairo 2019)

5. • *The acceleration by which an object moves when its initial speed is greater than its final speed.*
• *The acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.*
• *The acceleration by which an object moves when its speed decreases as time passes.*
6. *The acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.*
7. *The acceleration by which an object moves when its final speed is less than its initial speed. .* (Behira 2020)

4. Give reasons for :

1. *Physicists use mathematical relations like graphs and tables in many physical phenomena.* (Port Said 2020)
2. *(Distance - Time) graph of an object that moves at a uniform speed is a straight line passing through the origin point.* ((Sharkia 2019)Luxor 2020)
3. *The ratio d/t remains constant in case of a body that moves at a uniform speed.*
4. *(Speed - Time) graph of an object that moves at a regular speed is a straight line parallel to the time axis.*
5. *When the driver of a moving car uses the brakes, we describe the car movement as a decelerating motion.*
6. *The body which moves at acceleration can't move at a regular speed.* (Giza 2019. Damietta 2020)
7. *The acceleration is positive when its value increases, while it is negative when its value decreases.*
8. • *The object which moves at a uniform speed, its acceleration equals zero(*
• *A body moves at zero acceleration.* (Dakahlia 2019)

5. What is meant by ... ?

1. *The ratio d/t of a moving body is constant.*
2. *The slope of the straight line in graphic relationship (distance-time) of a moving body* Damietta 2011)
3. *The change in the object speed per a unit time equals 100 m/ sec^2*
4. *A body moves at a uniform acceleration equals 3 m/sec^2* (Ismailia 2018)
5. *A body moves by deceleration equals 2 m/ sec^2*
6. *A body moves at acceleration equals=3 m/sec*
7. *A car moves at 20 m/sec. and after 5 seconds, its speed becomes 15 m/sec*
8. *A body moves at zero acceleration.* (Rehira2018)

6.What happens when .. ?

1. *A body moves at a uniform speed (according to the acceleration).* (Giza 2020)
2. *The object's speed changes by equal values through equal periods of time.*
3. *The initial speed of a moving body is greater than the final speed*
4. *A car driver press the brake for stopping after a certain time.* (Matrouh 2017)

7. Draw a graph that illustrates each of the following:

1 A body moves at a uniform speed. . (Kalyoubia Ismailia 2017)
2. A body at rest. . (Ismailia 2016)
3. The relation (distance - time) for an object moves at a uniform speed and then is stops. (Dakahlia 2018)
4. A body moves at a regular speed 60 km/h. from the relation (Speed - Time)
5.A body moves at a regular acceleration 15 m/sec^2 from the relation (Speed - Time)
6. A body moves at zero acceleration. . (Kalyoubia 2017)
7. A body moves at a decreasing acceleration.
8. A body moves at an increasing acceleration. . (Suez 2020 Menofia 2020)

8. Problems:

1. **Calculate the acceleration** *of a moving car whose speed changes from 6 m/sec. to 12 m/sec during 3 sec.*

2. **A train moves from rest and its speed reaches 36 m/sec. in 9 seconds.**
 (a) Calculate the acceleration. **(b) What's the type of acceleration?**

3. **A special car** *can move from rest and its* **speed reaches 90 m/sec. in 10 seconds, What is the acceleration** *at which the car moved?*

4. **On a straight** *line there is a moving bus whose s***peed changes from 6 m/see. to 12 m/sec.** *during a period of* **3 seconds.**
 (a) **What** *is the amount of* **acceleration***?* *(b) What is* **its type***?*

5. **An object started its movement from rest and its speed changed into 36 km/h. in 10 seconds, calculate** *the object* **acceleration** *and state its type.* (Sharkia, South Sinai2017)

6. **A car moves at a speed of 54 km/h** *then the driver used the brakes to decrease its speed to 36 km/h in two seconds.* **Calculate** *the* **time** *needed to stop the car from the moment of using the brakes. [knowing that the car moves at uniform acceleration}.* **7. A car moves at a speed 72 km/***h, the driver uses the* **brakes,** *the car* **stops** *after* **8 seconds, calculate** *the* **acceleration** *at which the car moves.*

8. **A car moved from rest and its speed increased to 10 m/sec in 4 seconds,** *then the car's speed decreased to 5 m/sec in 2 seconds.*
Calculate:
 (1) The **acceleration** *with which the car moved during :*
 (a) the **first** *period.* *(b) the* **second** *period.*
 (2) **The time** *needed to stop the car if it moved in the same rate of change in speed in the second period,*

9. **A car moves at a speed of 40 m/sec.** *If the driver used the brakes to decrease the speed, so it* **decreases by 2 m/sec***:* **Calculate** *its* **speed** *after* **15 seconds** *from using the brakes* (Dakahlia 2019)

10. **A car moves at a speed 50 m/sec.** *If the driver used the brakes to decrease the speed, so it decreases by 2 m/sec:* **Calculate its speed** *after* **12 seconds** *from using the brakes:*

11. A train moves at a uniform speed of 20 m/sec. *When the driver uses the brakes, the train stops after 4 sec.* **Calculate** *the* **acceleration** *by which the train moves and mention the* **type** of acceleration.

12. A train moves at a speed of 40 m/sec. *at a uniform* deceleration 2 m/sec *If the brake is applied.* **Find** *the* **time** *taken* to stop *the train.* *(Gharbia 2020)*

13. **Calculate** *the* time *required for moving an object at* **acceleration** 4 m/sec, *knowing that the change in the* speed equals 28 m/sec.

14. A race car can move from rest position and its speed reaches 100 km/h through 20 seconds. **Calculate** *the* **acceleration** *of the car.*

15. If a boat starts to move from rest till its speed becomes 2.5 m/sec. through 5 sec. **find** :
(a) The **acceleration** *of the moving boat. (b) The* **type** *of the acceleration.*

16. A car moves at a speed 60 m/sec. *and when the driver uses the brakes to decrease the speed, so it* decreases to 30 m/sec. through 15 sec. **Calculate** *the* **time** *required to stop the car from the moment of using the brakes.*

17. Within 2.5 seconds, the speed of a car increases from 20 m/sec. to 25 m/sec., *while a bike moves from rest and its* speed reaches 5 m/sec. *in the same time.* **Calculate** *:*
(a) The **acceleration** *of the car and the acceleration of the bike.*
(b) Which one moves *at a* **greater acceleration** *?*

18. A bike started movement from rest and its speed reached 5 m/sec. in 2.5 seconds, *at the same time the speed of a car changed* from 20 m/sec. to 45 m/sec., **calculate** *their* **acceleration**, *then mention the* **type** *of acceleration.*

19. A Cheetah runs towards a deer at rest at a speed of 27 m/sec. *till catches it* after 10 seconds. **Calculate** *the* **acceleration** *by which the Cheetah moves*

33. A body moves in a straight line and the distances covered in different times are recorded in the opposite table *: (Assiut 2018)*
(a) **Represent** the **relation graphically**.
(b) **Calculate** the body **speed**. The time *(sec.)*

Distance (m)	0	3	6	9	12	15
Time (sec.)	0	1	2	3	4	5

34. The **distance** that is covered by a moving body through different times is recorded in the opposite table. *(Assiut 2015)*
(a) **Represent the relation graphically.**
(b) **Calculate** the **speed** *from the graph.*

Distance (m)	4	8	12	16	20
Time (sec.)	2	4	6	8	10

35. The speed that is covered by a moving body through different times is recorded in the opposite table *: (Assiut 2017)*
(a) **Represent the relation graphically.**
(b) **Calculate** the acceleration *from the table.*

Distance (m)	0	10	20	30	40	50
Time (sec.)	0	5	10	15	20	25

36. The opposite table shows the relation between the speed of a moving body and the time taken:
(a) **Draw the graphical** *relation between (V) on Y-axis and (T) on X-axis.*
(b) From the graph **find** *:* *1.* The **speed** of *the body after a time of 5 sec.*
2. The **acceleration** *of the body.* *(Behira 2018)*

Distance (m)	5	10	20	30	35	40
Time (sec.)	1	2	4	6	7	8

Chapter (3) Physical quantities scalars and vectors

الكميات الفيزيائية القياسية والمتجهة



Examples of physical quantities are:

Mass – length – time – force…..

All physical quantities are classified into two types

1-Scalars physical **2- vectors physical**

1- Scalar's physical quantities	2-vectors physical quantities
It is the physical quantity that has **magnitude** *only - **no** direction*	*It is the physical quantity has* **magnitude** *and* **direction**

Scalar physical quantities	Its measuring unit
Mass	Kilogram (kg)
Length=distance	Meter (m)
Speed	m/s or km/h
Time	Second or hour
Energy	Joule
Temperature	º C or F

Vectors physical quantities	Its measuring unit
Acceleration	m/s^2
Force	Newton
Velocity	m/s
Displacement	M
Wight	Newton

G.R.1- Length and time are scalar physical quantities?

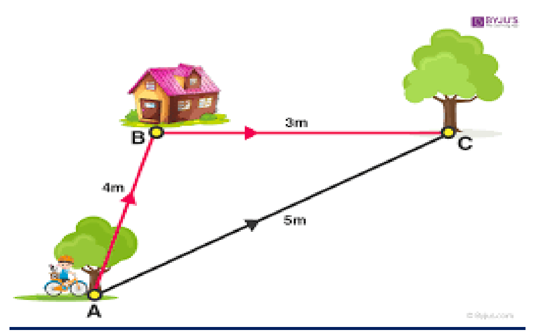
Because they have magnitude only - and have no direction

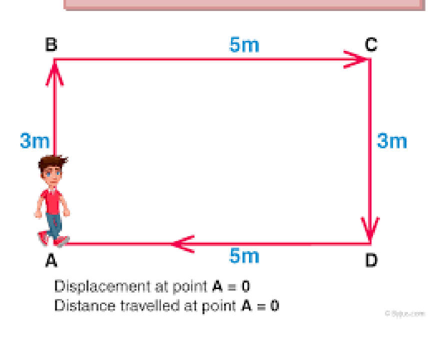
G.R.2- Acceleration and force are vector physical quantities?

Because they have magnitude and direction

Different between distance and displacement

Point of comparison	distance	displacement
definition	It is the **actual length** of the path that a moving object takes from the **start**(primary) point of movement to the **end** (final) point	It is the **shortest straight lin** between two positions. from the **start** (primary) position of movement towards the **end** (final) position
It is determined by	Magnitude *only*	Magnitude *and* direction
Its kind	Scalar *quantity*	Vector *quantity*
Measuring unit	Meter *or* kilometer	Meter *or* kilometer
Its simple	d	$\vec{d}$





Distance AB + BC

Distance 4 + 3=7m

Displacement AC

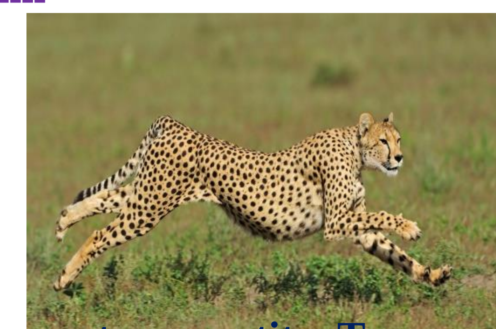
Displacement = 5m

Distance AB + BC+CD+DA

Distance 3 + 5+3+5=16m

Displacement AA

Distance = 0 m



The predator (cheetah) *is one of the fastest animals as it is possible that its speed reaches 27 m/minute in the east direction.*

To calculate the Velocity

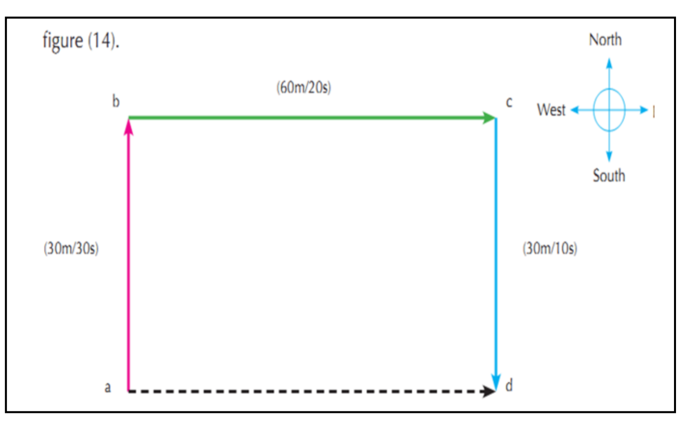
Based on previous observations, the velocity is a vector quantity. To determine it accurately, it is necessary to identify its magnitude and direction. Calculating the average velocity can be done through the following relationship:

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{total time}}$$

This means that the velocity is the displacement in one second.

It has the same speed units (meter / second or kilometer / second)

Example:



The distance covered by the person = 30+60+30=120 m

The displacement = 60m in the eastward direction

The average speed of the person $= \frac{\text{Total distance}}{\text{total time}} = \frac{120}{60} = 2 m/s$

The average velocity of the per In the eastward direction $= \frac{\text{displacement}}{\text{total time}} = \frac{60}{60} = 1 m/s$

What is meant by The average velocity of a moving car is 60 km/h?

This means that the displacement covered by a moving car is 60 km in one hour

Point of comparison	Speed	Velocity
definition	It is the **distance** covered in a unit time	It is the **displacement** covered in a unit time
It is determined by	**Magnitude** only	**Magnitude** and **direction**
Its kind	**Scalar** quantity	**Vector** quantity
Measuring unit	m/s or km/h	m/s or km/h

Guidelines to solve problems on distance and displacement

In straight line

The body movement	Figure	Distance (d)	Displacement ($\vec{d}$)
1- In a straight line in one direction *(From A to B)*	A (d) B	$\overline{AB}$	$\vec{AB}$ *In the east direction*
2- In two opposite direction *(From A to B) then from B to C)*	A C B, C	$\overline{AB}+\overline{BC}$	$\vec{AC}=\vec{AB}-\vec{BC}$ *In the east direction*
3- In two perpendicular direction *(From A to B) then from B to C)*	A, B, C	$\overline{AB}+\overline{BC}$	$\vec{AC}$ *In the south east direction*
4- In three perpendicular direction *(From A to B) then from B to C then C to D)*	A, B, C, D	$\overline{AB}+\overline{BC}+\overline{CD}$	$\vec{AD}$ *In the south direction*
5- In more than one direction, then return back to starting point *(From A then return back to A)*	A B	$2\,\overline{AB}$	**zero**
	A, B, C	$\overline{AB}+\overline{BC}+\overline{CA}$	
	A, B, C, D	$\overline{AB}+\overline{BC}+\overline{CD}+\overline{DA}$	

Guidelines to solve problems on distance and displacement

In circular path

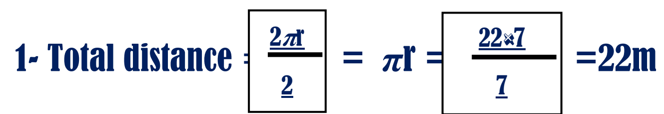
The body movement	Figure	Distance (d)	Displacement ($\vec{d}$)
1- In complete circle *From* *(A : B:C:D:A)*	B, A, C, M, D	*The circumference of the circle =2πr* $\pi = \frac{22}{7}=$ *r=radius)* *2πr*	**zero**
1- In a $\frac{3}{4}$ circle *From (A :B:C:D)*	A, M, Displacement, D	$\frac{3}{4}$ *circumference of the circle* $= \frac{3}{4} \times 2\pi r$ $\pi = \frac{22}{7}=$ *r=radius)* $\frac{3}{2} \times \pi r$	$AD=\sqrt{(AM)^2 + (DM)^2}$
1- In a $\frac{1}{2}$ circle *From (A : B:C)*	B, Displacement, A, C, r, M, r	*The circumference of the circle =2πr* $\pi = \frac{22}{7}=$ *r=radius)* πr	*The diameter* $\vec{AC}$*=2r in the east direction*
1- In $\frac{1}{4}$ circle *From (A : B)*	B, r, A, r, M	*The circumference of the circle =2πr* $\pi = \frac{22}{7}=$ *r=radius)* $\frac{1}{2} \times \pi r$	$AB=\sqrt{(AM)^2 + (BM)^2}$

problems

3- if you know that the circumference of the circle $=2\pi r$ (where $\pi=22/7$ –r=radius) in the opposite figure a body moves in a circular path its radius=7m from A to B within 3.5 second calculate

1-Total distance 2- displacement 3- velocity

B 14m A



1- Total distance $= \frac{2\pi r}{2} = \pi r = \frac{22 \times 7}{7}$ =22m

2- Displacement =14m

3- velocity $= \frac{d}{t} = \frac{14}{3.5}$ =4m/s

2- A racer covered 50 meters northward within 30 seconds then 100 meters eastward within 60 seconds then 50 meters southward within 10 seconds, and then returns back to the start point within 40 seconds:

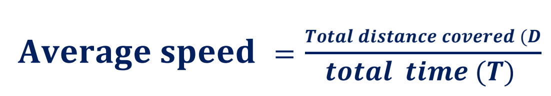
b 100m 60s c
50m 30s
50m 10s
a 100m 40s d



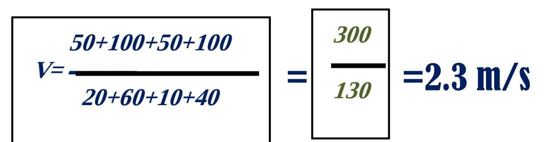
a -How long is the total distance the racer moved?

The total distance the racer moved=50+100+50+100=300m

b-What is the average speed of the racer?



Average speed $= \frac{\text{Total distance covered (D)}}{\text{total time (T)}}$



$V = \frac{50+100+50+100}{20+60+10+40} = \frac{300}{130}$ =2.3 m/s

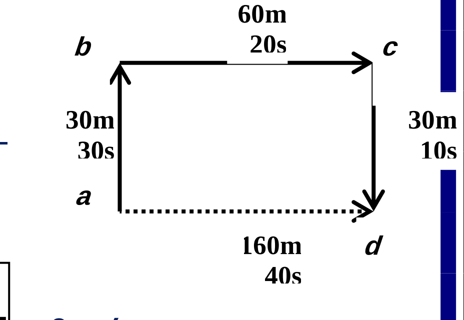
c- What is the displacement?

Displacement *It is the shortest straight line between two positions. from the primary position to the final position*

d-What is the average velocity? $\frac{100}{40}$ =2.5m/s

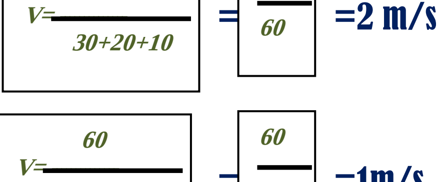
Average velocity *It is the displacement covered in one sec*

3- A person covered 30 meters northward within 30 seconds then 60 meters eastward within 20 seconds then 30 meters southward within 10 seconds Calculate: 1- Average speed. 2- A average velocity



1- Average speed.

Average speed (V)= $\frac{\text{Total distance covered (D)}}{\text{Total time (T)}}$



$V = \frac{30+60+30}{30+20+10} = \frac{120}{60}$ =2 m/s

2- A average velocity.

Average speed (V)= $\frac{\text{Total displacement covered (D)}}{\text{Total time (T)}}$

$V = \frac{60}{60} = \frac{60}{4600}$ =1m/s

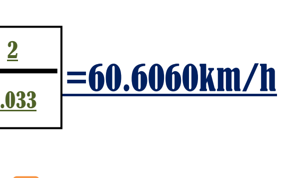
4- in the opposite figure a car start motion from point (A)to (F)passing by points B,C,D and E calculate

1-Total distance 2-displacement3-velocity if the time 0.033 hours

B 4 C
5 3 2
A 3 E D F

1-Total distance=5+4+2+3+3=12km

2-displacement=4-3=1km



3-velocity if the time 0.033 hours $v = \frac{d}{t} = \frac{2}{0.033}$ =60.6060km/h

Unit one Lesson three

1- Choose the correct answer:

1. The scalar quantity is identified by its

a. magnitude only. b. direction only.
c. magnitude and direction. d. magnitude and velocity

2. ……….is a scalar physical quantity that is identified by magnitude only.

a. Velocity b. Acceleration c. Time d. Force

3 All of the following are scalar quantities except

a. length. b. force. c time d. mass.

4. To determine the length, mass and time, we must know

a. the magnitude and the direction b. the magnitude and the measuring unit.
c. the direction and the measuring unit.
d. the magnitude, the direction and the measuring unit. (Kalyoubia 2020)

5. From the examples of the scalar physical quantities are ….

a. the length and the acceleration b. the time and the weight.
c. the mass and the velocity. d. the time and the speed.

6. Which of the following physical quantities are considered as scalars only ? (Port Said 2015)

a. The force and the time. b. The mass and the force.
c. The radius and the area d. The displacement and the acceleration.

7. From the examples of the scalar quantities is the …….. (Sue Menofia 2019)

a. velocity. b. mass. c. force. d. acceleration.

8. is the physical quantity that both its magnitude and direction are necessary for identifying it.

a. The quantity of matter b. Scalar quantity
c. Vector quantity d. No correct answer

9. Which of the following physical quantities are considered as vectors only? (Gizo 2020)

a. The mass and the force. b. The displacement and the acceleration
c. The radius and the area. d. The force and the time..

10. From the examples of the vector physical quantities is . (Red Sea 2020)

a. displacement. b. mass. c. time. d. distance

11. One of the vector physical quantities is

a. time of a car trip b. length of a pen.
c. mass of a cat d. force by which a person pushes..

12. is a vector quantity measured in m/sec.

a. Velocity b. Acceleration c. Speed d. Displacement

13. Acceleration is a……..

a. vector quantity whose unit is m/sec^2 b. vector quantity whose unit is m/ sec^2
.. c. scalar quantity whose unit is m/ sec^2 d. scalar quantity whose unit is m/sec.

14. The shortest distance covered by the object in a certain direction is called

a. distance. b. displacement. c. acceleration. d. speed.

15. Displacement is a……….. (Menofia 2017.

a. scalar quantity and its unit is meter. b. vector quantity and its unit is m/sec.

c. vector quantity and its unit is kilogram. d. vector quantity and its unit is meter

16. The distance and displacement are equal when the body moves in a ….. in one direction

a. zigzag a . in one direction. c. straight line d. curved

17. From the b. circular opposite figure, when an object moves from point (A) to point (D) passing through points (B) and (C), the displacement from (A) to (D) ……… equals in the direction (AD).

a. 20 cm. b. 40 cm. c. 60 cm. d. 80 cm.

18. In the opposite figure, a body starts its motion from point (A) directed to the south to point (B), it covers (A) a distance of 40 m, then it is directed to the east to point (C) which far 30 m apart from the point (B), so

(A) The value of the body displacement equals

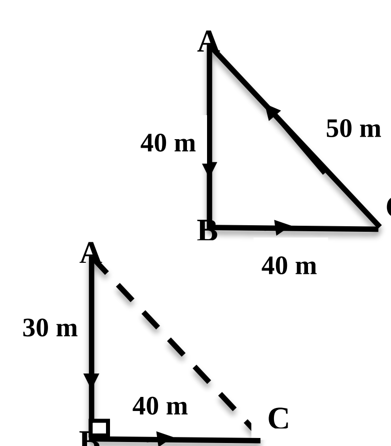
a. the length of AB. b. the length of BC.

c. the length of AC. d. the length of AB + BC.

(B) The length of the distance covered equals

a. the length of AB. b. the length of BC.

c. the length of AC. d. the length of AB+ BC.



19. In the opposite figure, a body starts its motion from point (A) to (B), then to point (C), then returned to point (A), so the distance covered equals…….. meter

a. 70. b. 30.

c. 50. d. 40.

20. In the opposite figure, an object starts movement from point (A) to point (C) passing through point (B), so its displacement is

a. 70 b. 30 c. 50 d. 40 40m (Men 2018).

21. A body moved a distance of 20 metres in a straight line in the same direction, so the amount of its displacement is ..

a. 20 m. b. 40 m. c.80 m d. zero.

22. If a person moves 8 m to the north, then 4 m to the east, then 8 m to the south, his displacement equals ………… in the east direction. (Luxor 2013)

a. 20 m b. 4 m c. 8 m d. 12 m

23 ……. is considered from the fastest wild animals.

c. Cheetah. a, Wolf b. Lion d. Elephant

24. Measurement unit of velocity is…….. (Matrouh 2016):

a. m. sec. b. m/sec. c. m. d. m/sec^2

25. The average velocity is determined by the relation……………

a. distance/time. b. distance x time. c. displacement/time. d. speed/time.

26. The plane which flies against the wind direction than that which flies in the same direction of wind.

a. consumes more fuel b. takes longer time

c. its speed increases d. (a) and (b) are correct

27. From the opposite figure, when an object moves from point (A) to point (B), the displacement from (A) to (B) equals……cm

$a. 10\sqrt{2}$ $b. 10$
$c. 20$ $d. 31.4$

2. Choose from column (B), what suits it in column (A)

(A)	(B)
Distance	a. is the shortest distance covered by the object in a fixed direction
Speed	b. is the distance moved through a unit time
displacement	c. is the speed of a moving object relative to the observer.
Relative speed	d, is the actual length of the path that a moving object takes from the start point of movement to the end point.

3. Correct the underlined words :

1. *The distance is a vector physical quantity and its measuring unit is the metre,*
2. *The length is a vector quantity.*
3. *The force is from scalar physical quantities.*
4. *The time is a vector physical quantity.*
5. *The distance is a vector quantity and the displacement is a scalar quantity.*
6. *Mass is a vector physical quantity and its measuring unit is kilogram.*
7. *Speed is a vector physical quantity.*
8. *In the opposite figure an object moves eastward from point (a) to point (b) during two seconds, then to point (e) northward in 3 seconds, so its velocity through that period is 1.4 m/sec. (Kalyoubia 2020)*

c
a
b

9. *Displacement is characterized by both magnitude and time.*
10. *The vector physical quantities need magnitude only to be determined.*
11. *Velocity =* $\frac{\text{Distance}}{\text{Total time}}$ *(Aswan 2019)*
12. *Velocity is the quantity that we can identify it accurately by knowing its magnitude only . (Kalyoubia 2014*
13. *Regular speed is the value of displacement in one second. (Cairo 2020)*
14. *To determine the density we must know its magnitude and direction.*
15. *Acceleration is the actual length of the path that a moving object takes from the starting point of movement to the end point. (Sharkia 2019/ Gharbia 2020)*
16. *The value of distance is the length of the shortest straight line between two positions. (Menia 2019/Behira 2020*
17. *A person moves 40 m northward then returned 20 m southward, so his displacement is 60 m northward. (Qena 2019)*
18. *A racer covered 50 m northward, then 10 m eastward, then 50 m southward and then returned back to the starting point, so the value of his displacement equals 300 m.*
19. *When an object moves in a curved line in one direction, the covered distance is equal to the displacement.*
20. *The regular speed is the scalar speed, but in a given direction.*

21. The displacement measurement unit is __m/sec.__
22. Velocity is the rate of change of __acceleration__.
23. The measuring unit of velocity is __sec./m.__
24. __Lion__ is considered one of the fastest wild animals.
25. Pilots take in consideration the __uniform speed__ of the wind.

4. Write the scientific term of each of the following :

1. •The physical quantity that has magnitude only and has no direction.
• The physical quantity which magnitude is enough for identifying it.
2. The physical quantities that include time, length and mass. (Ismailia 2013)
3. The physical quantity enough to identify it magnitude as well as direction. (Suez 2016)
4. The physical quantity that refers to the change in the speed of an object in a unit time. (Port Said 2016/ Beni Suef 2019)
5. The distance covered in a certain direction between the starting point and the ending point. (Luxor 2018/Qena 2019/ Giza 2020)
6. The vector quantity which is measured in km/h.
7. The vector physical quantity which is measured in m/sec^2
8. The length of the shortest straight line between primary position and final position. (Menofia 2018) (The New Valley 2017,2019)
9. The actual length of the path that a moving object covers from the starting point to the ending point of the motion. (New Valley 2020)
10. The rate of change of displacement. (Behira 2014 / Matrouh 2019)
I1. The displacement covered in one second. (Menia, Qena 2020)
12. The predator wild animal that its velocity is represented by determination the direction of its motion. (Fayoum 2015)

5. Give reasons for :

1. Mass, length and time are considered scalar physical quantities. (Sohag 2015, 2016)
2. Force is a vector physical quantity. (Menofia 2019/Suez 2020)
3. Distance is a scalar quantity, while displacement is a vector quantity.
4. Acceleration is a vector physical quantity. (North Sinai 2020) (Beni Suef 2015)
5. The velocity is a vector physical quantity. (North Sinai 2018, 2019)
5.When an object moves, where its starting point is the ending point, its velocity is zero
6. The amount of consumed fuel by a plane flies between two cities differs according to the wind direction. (Menofia 2019/ Menia 2020)
7. Pilots take in consideration the velocity of the wind during their flights.

6. What is meant by.?

1. Length is a scalar physical quantity.
2 Force is a vector physical quantity
3. A The body moves 60 metres and the value of the displacement equals zero
4.The displacement of an object is 50 metres in east direction.
5. Displacement equals the covered distance.
6. A body covered 40 m northward direction in 20 sec.

7. The distance which an object travels in the cast direction equals 30 m.
8.The value of the length of the shortest straight line between two positions equals 5 m.

7. Problems :

1. A rubber ball falls from a height of 10 metres, then it rebounds from the ground upward distance of 5 metres, then falls down to rest on the ground. Calculate
(a) The **distance** *covered,* *(b) The* **displacement**.

2. If you move to a distance of 5 metres northward and your colleague moves to a distance of 5 metres southward, compare between :
(a) The **distance** *that you covered and the distance that your colleague covered.*
(b) The **displacement** *that you covered and the displacement that your colleague covered.*

3. An object moves in a straight line northward at a speed of 5 m/sec, and its speed reaches 20 m/sec. through 3 seconds. Calculate the following :
(a) The **velocity** *after 3 seconds.* *(b) The* **acceleration** *of the moving object.*

4. An object moves 8 m to the east then moves 5 m to the west determine.
The magnitude and the direction of the object's displacement. *(Menofia 2019)*

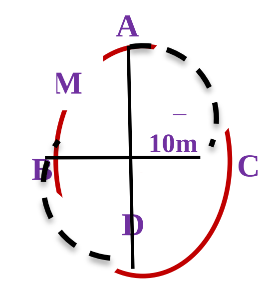
5. A body moves from point (A) to point (B), then change its direction to point (C) through 10 sec. Calculate.
(a) Total **distance** *which the body moved.*
(b) **Displacement** *done by the body.*
(c) The **velocity**. *(Damietta 2016 Ismailia 2019)*

6. A car covered 600 m in eastward direction within 60 sec. Find its average velocity.

7. In the opposite figure, a body moves in a circular path, its radius = 7 m from (A) to (C) passing by point (B) within 3.5 sec. If you know that the circumference of the circle = *2 πr (where* $\pi = \frac{22}{7}$*, r = radius).* **Calculate** *:*
(a) Total **distance**. *(b)* **Displacement**.
(c) **Velocity**. *(Kalyoubia 2015)*

8. In the opposite figure : An object is moving from point (C) to point (M), passing by two points (D, F) in 5 sec., Calculate *: (a) The covered distance.*
(b) The velocity *(Luxor 2020)*

9. In the opposite figure, a car moves in a circular path whose radius is 10 metres, the car movement changed as in the opposite figure if you know that the circumference of the circle *2 πr where (π= 3,14),* **Calculate** *:*



(a) The total **distance** *covered by the car from point (A) to point (D) passing by points (B) and (C).*
(b) **Displacement**.

10. A person covered 30 meters northward within 30 seconds, then 60 metres eastward within 20 seconds, and then 30 metres southward within 10 seconds. Calculate:

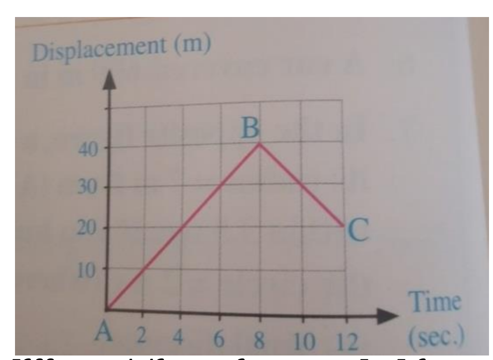
(a) The value of the **total distance**

(b) The **average velocity**, *then mention its* **direction**.

11. A car moved from Benha to Cairo at a distance 40 km in 30 min., then it returns back from Cairo to Benha in the same time. Calculate in km/h :

(a) The car **velocity** *from the beginning to the end of the journey.*

(b) The **average speed** *of the car during the total time.*



13. The opposite graph represents the movement of a body from point (A) to point (C) passing by point (B). Calculate:

(a) Its **speed**. *(b) Its* **velocity**.

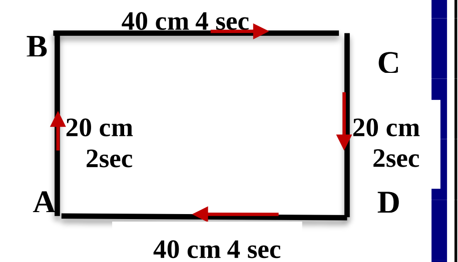
(c) The **acceleration** *by which the body moves (AB).*

15. The displacement covered by a moving body through different times is recorded in the following table:

displacement (m)	*10*	*20*	*30*	*40*	*50*	*60*
Time (sec.)	*5*	*10*	*15*	*20*	*25*	*30*

(a) **Represent the relation graphically**

(b) **Calculate** *the* **velocity** *from the graph*



16. In the opposite figure, an object starts moving from point (A), then it returns to it again through the points (B), (C) & (D), Calculate :

(a) Total **distance** *covered by this object.*

(b) **Average speed**,

(c) **Displacement**.

(d) **Velocity**.

B
60m 40 sec
C
50m
30 sec
40m
20 sec
A
90m 60 sec
D

17. In the opposite figure, a person starts his motion from point (A) to pass with points (B), (C) & (D) till he reaches to starting point (A),

where (AB 50 m in 30 sec.)

and (BC 60 m in 40 sec.) and (CD 40 m in 20 sec.)

and (BC 60 m/40 sec C) (DA 90 m in 60 sec.).

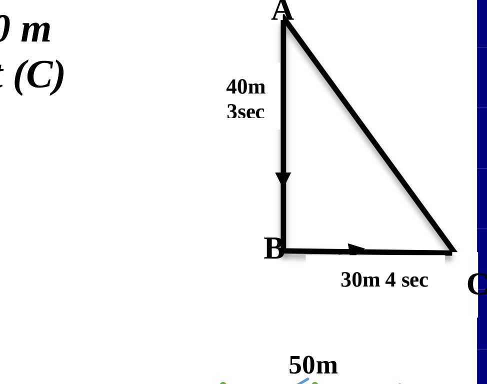


Find: *(a) The* **average speed**. *(A) 90 m/60 sec*

(b) The **displacement**,

(c) The **acceleration in period from (D) to (A)** *if the speed of the moving person is constant.* *(Dakahlia 2018)*

18. In the opposite figure, a body starts its motion from point (A) directed to the south to point (B), *it covers a distance of 40 m through 3 seconds, then it is directed to the east to point (C) which far 30 m apart from point (B) through 4 seconds.*



Calculate :

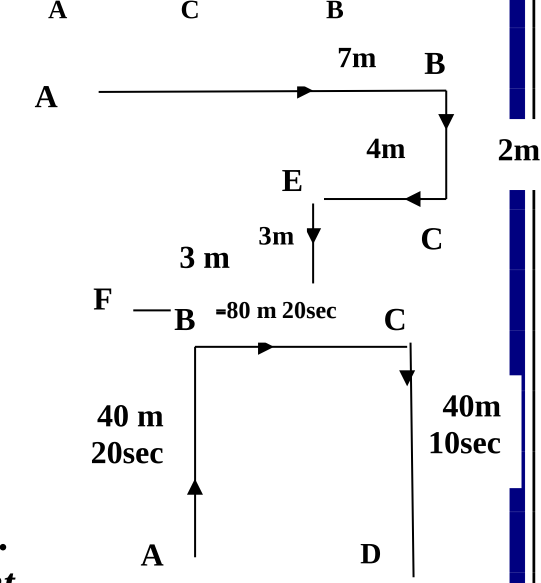
(a) The **distance** *covered. (b) The* **average** *speed.*

19. A body moves as shown in the opposite fig. from point (A) to point (B) and covers a distance of 100 m through 20 sec., *then to point (C) and covers a distance of 50 m through 5 sec.* **Calculate** *:*

(a) Distance. (b) Displacement.

(c) Velocity.

50m



20. A body moves in the path (ABCDEF) as in the opposite figure. Calculate:

(a) The distance that the body moved.

(b) Displacement of the body. (Kalynulia 2018)

21. A car starts motion from point (A) and covers 40 metres northward to point (B) within 20 seconds.) then 80 metres eastward to point (C) within 20 seconds and Find*:*

(a) Total distance covered by this car.

(b) Total time that the car took to cover this distance.

(c) Displacement from the start point to the end point.

(d) Average velocity of this car. (Menia 2017)

B 30 m 10sec C

40 m 20sec A

40m 8sec

D

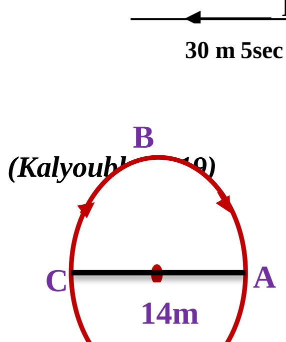
30 m 5sec

22. A person moves in the path (ABCDE) as shown in figure, *(B) 30 m (10 sec.) (C) he coverers a distance of 10 m northward in 2 sec., then he covers 30 m eastward in 10 sec. and followed by 40 m southward in 8 sec., finally 30 m westward in 5 sec.: (A)*

(a) **Calculate the displacement** *of the person from the start of motion to the end.*

(b) In which part of the person motion, his speed **was the least** *? (Kalyoub… 19)*

23. In the opposite figure the perimeter (circumference) (B) of this circle *is 44 metres and the diameter is 14 metres. When an object moves from point (A) to point (B) to point (C) in 10 seconds. (C) (A) 14 m* **Complete :**



(a) Distance =……….. metres.

(b) Displacement = . metres in …….. direction.

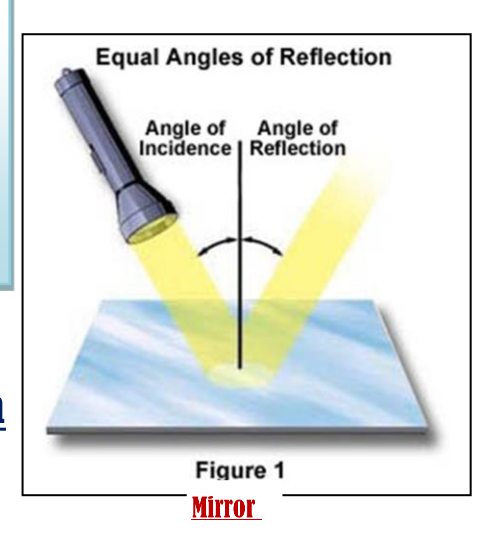
(c) Velocity =.. . ………..m/sec. in . direction. (Behira 2011)

Unit (2) Light Energy

Chapter (1) Mirrors

Light Reflection

It is the phenomenon of the light bouncing off (return back) in the same medium when it meets a reflecting surface



Mirror

Concepts concerning reflection of light:

المفاهيم المتعلقة بانعكاس الضوء

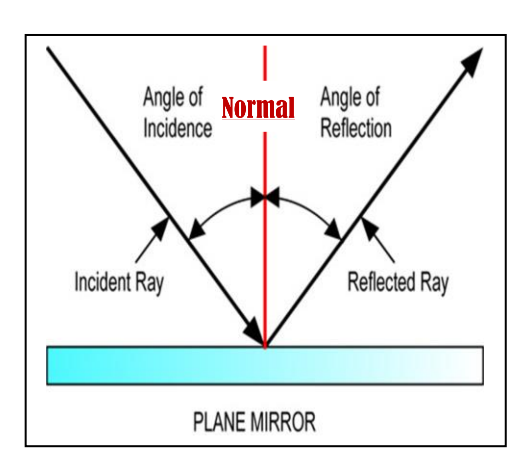
1-The incident ray: it is the light ray that falls on the reflecting surface

2-The reflected ray: it is the light ray that bounces (return back) from the reflecting surface

3-Angle of incidence: it is the angle between the incident ray and the normal

4-Angle of reflection: it is the angle between the reflected light ray and the normal

5-The normal: it is the perpendicular line to the reflecting surface on the point of incidence



Laws of the reflection of light:



1 -First law : *angle of incident = angle of reflection.*

2 -Second law: *the incident light ray and the reflected light ray and the normal all lie in one plane perpendicular to the reflecting surface*

G.R. The incident ray which falls perpendicular on a reflecting surface reflects on itself?

Because the angle of incident and the angle of reflecting = zero

What is the meant by



1- Angle of incidence of light ray is 60˚?

It meant that the angle between the incident ray and the normal =60 ˚



2- The angle between the reflected ray and the normal =30 ˚ ?

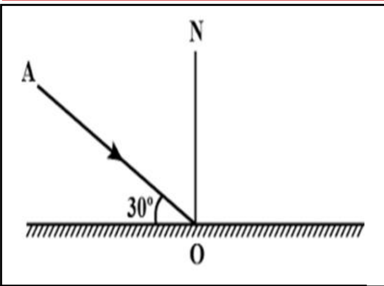
It meant that Angle of reflection of light ray is 30˚

3- The angle of incident of ligt ray equal zero?

It meant that this angle of light ray fall perpendicular of a reflecting surface

problems

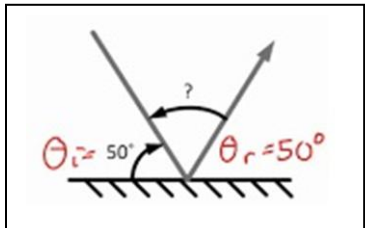
1-Fined the angle of incident and angle of reflection for all the followings



Angle of incident =90-30=60°
Angle of incident =angle of reflection
60°=60°

Normal
Incident ray
35
Reflected ray
Plane mirror

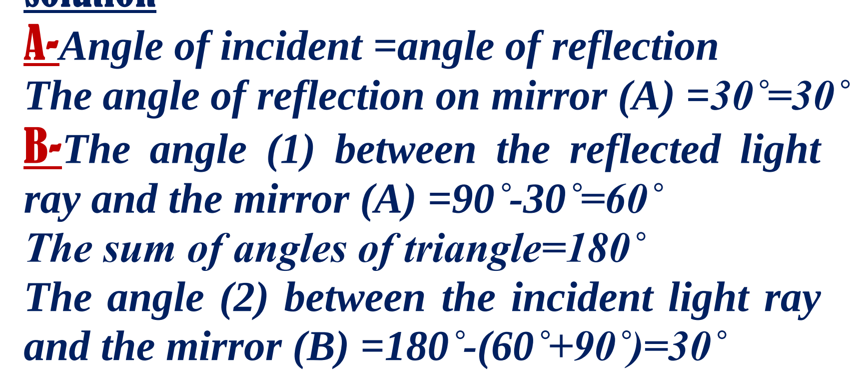
Angle of incident =angle of reflection
35°=35°



Angle of incident + angle of reflection =180-100=80°
Angle of incident = $\frac{80}{2}$ *=40°*

30°
A
B
O

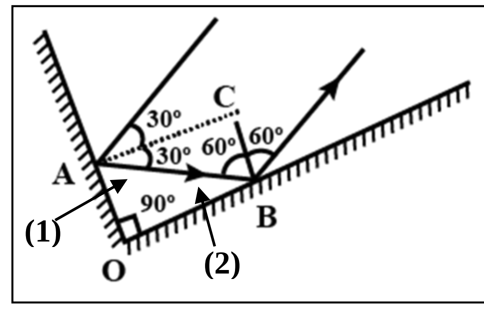
2-In the opposite figure
An incident light ray fall von mirror (A) and then reflected on mirror (B) calculate each the following
A-The angle of reflection on mirror (A)
B-The angle of incident on mirror (B)



Solution

A- *Angle of incident =angle of reflection*
The angle of reflection on mirror (A) =30°=30°

B- *The angle (1) between the reflected light ray and the mirror (A) =90°-30°=60°*
The sum of angles of triangle=180°
The angle (2) between the incident light ray and the mirror (B) =180°-(60°+90°)=30°
The angle of incident on mirror (B) =90°-30°=60°

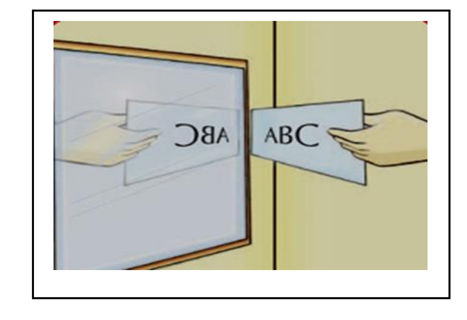


Mirrors		
First plane mirror	Second spherical mirror	
	A-Concave mirror	B-Convex mirror

First plane mirror

plane mirror *is a piece of plane glass, painted from behind with a thin layer of silver metal to give glass a bright surface that reflects the incident rays that fall on it*

Activity The properties of the image formed by the plane mirror



The material:

A plane mirror - white paper sheet Pins - ruler - protractor

The steps:

1- Place the card in front of the mirror that is fixed vertically.
2-Record your observation on the properties of the image formed in the plane mirror

The properties of the image formed by the plane mirror



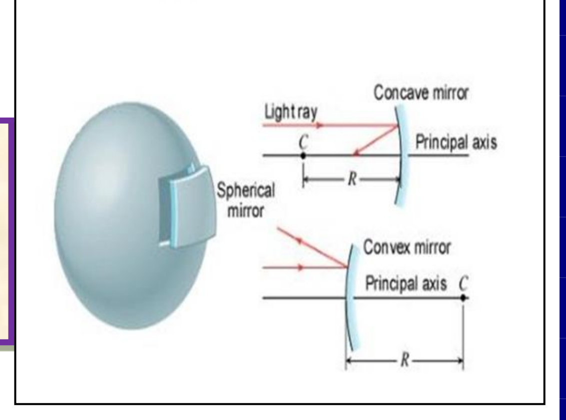
1- The image is upright
2-The image is equal to the object.
3-The image is laterally inverted.
4 -The image is a virtual image (cannot be received on a screen)
5 -The distance of the object to the mirror= the distance of its image to the mirror.
6-The straight line connecting the object and its image is perpendicular on the surface of the mirror

G.R. The word Ambulance is written in a converted way on the Ambulance car?



To appear in the mirror of the cars in front of Ambulance written in correct way and can be read by the drivers

Second spherical mirrors



The spherical mirrors

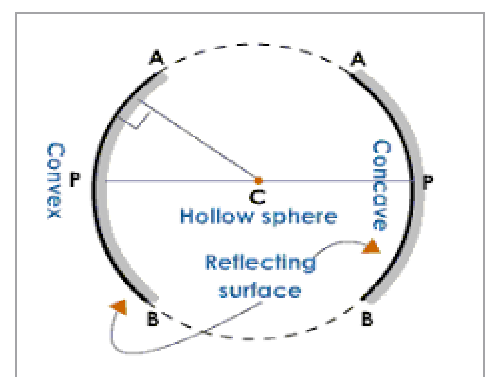
It is a mirror that its reflecting surface is a part of a hollow sphere

- There are two types of the spherical mirrors.

The types of the spherical mirrors

Concave mirror (converge)	Convex mirror (diverge)
its reflecting (shinning) surface is a part of the inner surface of the sphere	*its reflecting (shinning) surface is a part of the outer surface of the sphere*
It called **converge** G.R *Because it* **collects** *the parallel light rays that falls on its surface*	*It called* **diverge** G.R *Because it* **diverges** *the parallel light rays that falls on its surface*



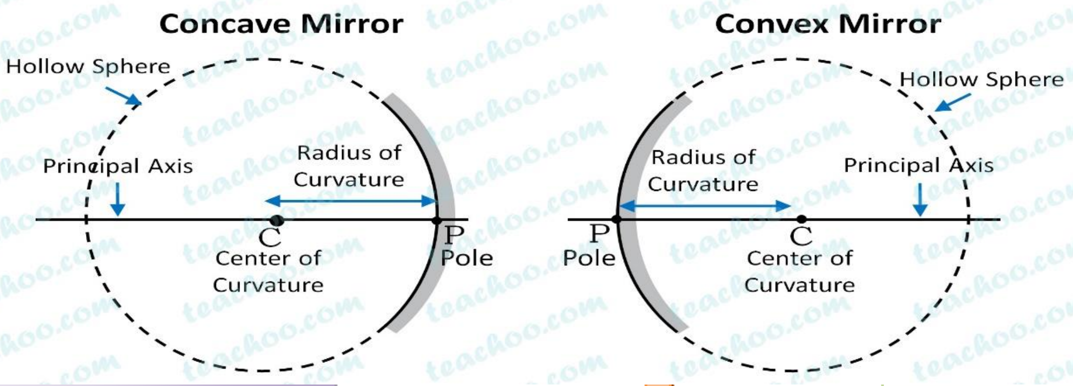




G.R. The stainless –steel spoon is considered as a spherical mirror?

Because it's inner surface is concave mirror
While it's outer surface is convex mirror

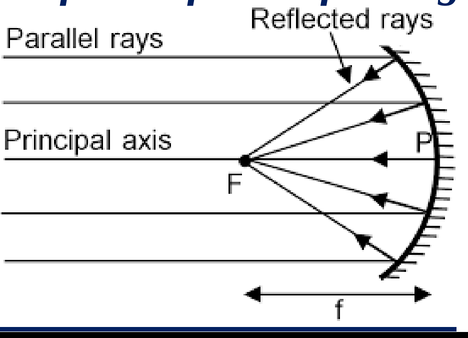
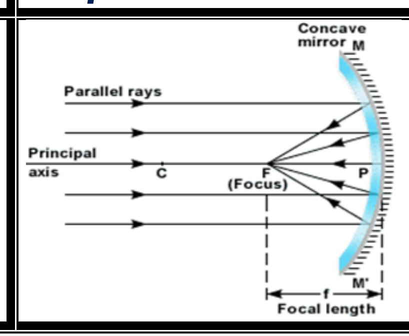




Identify the concave mirror and the convex mirror.

Identify the concept that benefits you when are studying how the image is formed by the spherical mirrors:

Concept	Definition	Figure
1-Centre of mirror curvature (C	*Is the Centre of the sphere that the mirror is considered as a part of it* *Its position* **the concave mirror** *(in front of the reflecting surface* *In* **the convex mirror** *behind the reflecting surface)*	
2-The pole of the mirror (p):	*Is the point that lies in the middle of the reflective surface of the mirror*	
3- radius of mirror curvature (r):	*It is the distance between the center of mirror curvature (C) and any point on its surface* *It is the radius of the sphere that the mirror is a part of it (r).*	
4-The principal axis (cp)	*Is the straight line that passes by the pole of the mirror and its center of curvature*	
5-The secondary axis	*Any straight line that passes by the center of curvature of the mirror and any point on its surface except the pole of the mirror*	

6-The focus of the concave mirror	it is the point collection of the reflected light rays (in the concave mirror) *real* in case of the concave mirror on front of the reflecting surface 	*virtual* in case of the convex mirror behind the reflecting surface
7- focal length of the mirror (f)	It is the distance between the focus of mirror(f) and its pole(P) $f = 1/2\ R$	

G.R. the spherical mirror has only one principle axis and uncountable number of secondary axis?

-it has only one principle axis *bec. It has one center of curvature and one pole,*

-it has uncountable number of secondary axis *bec. Secondary axis is any straight line passes by its center of curvature and any point on its surface except the pole*

The relation between the radius, diameter and focal length

The radius of curvature= 2× Focal length

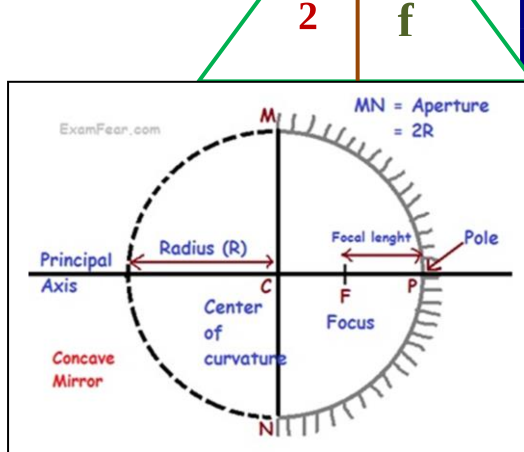
$$\text{Focal length} = \frac{\text{radius of curvature}}{2}$$

$$\text{Radius of curvature (r)} = \frac{1}{2}\text{ diameter}$$

$$\text{Focal length} = \frac{1}{2}\text{ radius}$$

$$\text{Focal length} = \frac{1}{4}\text{ diameter}$$

r | 2 | f



Problem calculate the radius of curvature of concave mirror whose focal length is 8cm

Focal length =8 cm

Radius of curvature (r) =2× Focal length (f) =2×8=16 cm

What is the meant by

1- The focal length of spherical mirror is 10 cm?

It meant that It is the distance between the focus of mirror(f) and its pole(P) is **10 cm**

2- The Radius of curvature of spherical mirror is 20 cm?

It meant that It is the distance between the center of mirror curvature (C) and any point on its surface is **20 cm**

Real image	Virtual image
can be received on screen	cannot be received on screen
It formed as result of the intersection of reflected light rays	It formed as result of the intersection of extensions light rays
It is always inverted	It is always upright

The image formed by the concave mirror

The path of the incident ray	The path of the reflected ray	Explaining figure
The incident light ray parallel to the principal axis of the mirror.	It reflects passing through the focus F	Rule 1 - Ray parallel to principal axis will pass through focus after reflection (teachoo.com) C F P Concave Mirror; P F C Convex Mirror
The incident light ray passing through the focus F	It reflects parallel to the principal axis	ExamFear.com C F P Concave Mirror; P F P Convex Mirror
The incident light ray passing through the Centre of curvature C	It reflects back on itself	ExamFear.com F C P Concave Mirror; P F C Convex Mirror

The Properties of the image formed by the mirror

Position of the object	Characteristics of the images	The cases of image formation	Position of the image
very far	-Real - inverted -very tiny (dot)	Concave mirror M, Parallel rays, Principal axis, C, F (Focus), P, M', f, Focal length	at the focus
At a distance larger than the radius of curvature.	-Real - inverted - smaller than the object (diminutive) مصغر	R, Object, Q, C, Q', F, P, R', Image, B, A	Between the focus and the center of curvature
At the centre of curvature of the mirror.	Real -inverted-- Equal the object	R, Object, Q, Q', C, Image, R', F, P, B, A	At the center of curvature of the mirror
Between (c) And (f).	Real - inverted - larger than object	A, B', C, B, F, D, E, A'	At a distance greater than the radius of curvature
Between (f) and (p).	virtual - upright - larger than object- (magnified)	C, F, B, A, P, A, B; When the Object is Between the Pole and the Focus	Behind the mirror
The formation of the images on a convex mirror	virtual -upright smaller than - the object, virtual (not received on a screen	A, B, P, A', B', F, C	Behind the mirror is always

G.R. Concave mirror is used in solar ovens and solar furnaces الافران الشمسية؟

To collect a large amount of solar energy in the focus of mirror for cocking food or melting metals



G.R. Convex mirror is used as a side-view mirror on the passenger's side of a car

Because it form an erect smaller image for the way behind the car

Activity: Determine half the radius of the concave mirror.

The materials: *A concave mirror – a holder for the mirror – light box with a hole*

The steps

1-Place the mirror on a holder in front of the light source (lit hole).

2-Move the mirror nearer and farther until an image of the hole is formed next to it and is equal to it.

3-Measure the **distance between the mirror and the hole**, *it is equal to* **the radius of curvature of the mirror.**

Deduce: *The focal length of the mirror (f) =* **half the radius of curvature (R)**

Focal length $= \frac{1}{2}$ *radius*

Uses of mirror



1-in pocket torch

to reflect the light of the lamp

2- in front light of cars to reflect the light of the lamp



3- in shaving

to get enlarged and erect image of the face

4-in marine lighthouses in marine parts and airports

to reflect the light of the lamp to guide ships



5-in aircrafts landing at airports to reflect the light of the lamp to guide airplanes

Unit Two Lesson one

1- Choose the correct answer:

1. The bouncing off the light ray in the same medium when it meets a reflecting surface the .

a. incident ray. *b. reflected ray.*

c. light reflection phenomenon. *d. light refraction phenomenon.*

2. If a light ray falls on a reflecting surface by an angle equals 45°, the angle of ref equals

a. 35°. *b. 90°.* *c. 55°.* *d. 45°.*

3. When a light ray falls perpendicular on a reflecting surface, its angle of reflection equals

a. zero. *b. 30°.* *c. 60°.* *d.90°.*

4. If the angle between the incident light ray and the reflected light ray is 40°, its am reflection equals ..

a.20. *b, 40°.* *c. 80°.* *d. 90°.*

5. A light ray is incident on the surface of a plane mirror, as in the figure it reflects where the angle of incidence equal . *(Beni Suef 2020)*

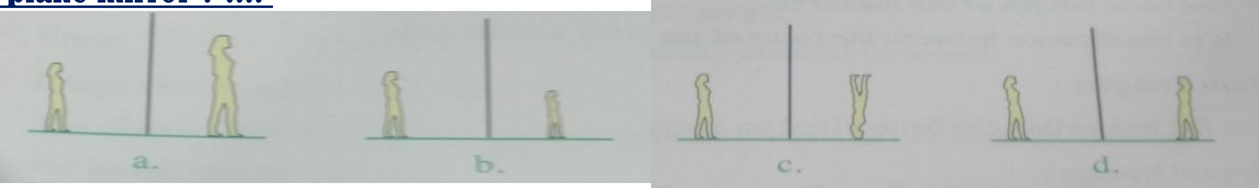
140

a. 40 *b. 50°.* *c . 70°..* *d. 140°.*

6. If a person was putting a pen in his left pocket, then the formed image of the pen on a plane mirror will be on the ……….side as it is …….

a. left - reversed *b. right- up right.* *c. right- reversed* *d. left-virtual.*

7. Which one of these figures represents the correct image for an object placed in front of a plane mirror ? ….



8. If you stand in front of a plane mirror at a distance of 2 m, the distance between you your image is ……….

a. 1 m. *b. 2 m.* *c. 3 m.* *d. 4 m.*

9. If the distance of the object to the plane mirror is 10 cm, the distance of its image to mirror

a. 5 cm. *b. 10 cm.* *c. 20 cm.* *d. no correct answer.*

10. The image of the body formed behind the plane mirror is always

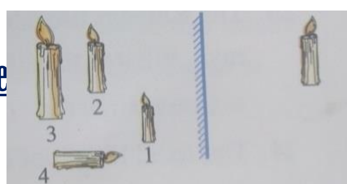
a. virtual - enlarged - erect. *b real - diminished-inverted.*

c. real - equal - reversed. *d. virtual - equal - erect.*

11. If you put a plate written on it the word (*Light*) in front of a plane mirror, it appears in the mirror as a plate written on it ..

a. Light *b.* ʇɥƃᴉ˥ *c.* *tdgil.* *d. no correct answer*

12. If a candle is put in front of a plane mirror, which one of the image you see ?



a.1 *b. 2* *c. 3* *d. 4*

13. If the angle of incidence equals 45 , so the angle between the reflected light ray and the reflecting surface equals ..

a. 45°. *b. zero.* *C. 90 °* *d. 60 °*

14. If a light ray falls on a smooth (plane) mirror as shown in the opposite fig. it reflects by an angle of reflection equals..

° a. zero. b. 60°. c. 30° d. 120

15. A light ray that falls on a plane mirror as in the figure it reflects, where the angle of reflection equals..... .

(New Valley, Damietta 2017)

a. zero b. 60°. c. 90°. d. 120°.

16, The reflected light ray when falling on another reflecting surface called ....

a. the light reflection. b. the reflected light ray. .

c. the angle of incidence d. the incident light ray. ,

17. If you put an object in front of a plane mirror, the ratio between the length of the image and the length of the object is . *(North Sinai Red Sea 2019)*

a. more than one. b. less than one. c. equal to one. d. no correct answer.

I8. A body was put in front of a plane mirror at a distance 4 metre, an image is formed behind the mirror. If the mirror moved towards the body one metre, the distance between the first image and the second image is metre.

a.1 b. 2 c. 3 d. 4

19. The optical piece which forms an equal laterally inverted image of the body is the

a. convex lens. b. concave lens. c. spherical mirror d. plane mirror.

20. The point at the middle of the reflecting surface of a spherical mirror is called

a. focus of mirror b. pole of mirror.

c. centre of curvature. d. face of curvature.

21. The straight line that passes by the pole of the mirror and its centre of curvature is expressed the . *(Bent Suef 2015/Fayeum 2016 / Alex 2017)*

a. pole of the mirror b. secondary axis of the mirror

c principal axis of the mirror. d. no correct answer.

22. The parallel rays that are incident on the plane mirror are reflected back as ......rays

a. diverging b. converging c. parallel d. refracted

23, The Romans use a huge optical piece to burn the sails of enemies' ships by using the Sun rays. What is the suitable optical piece to do that ? .. *(Port Said 2014, 2018)*

a. Convex mirror b. Concave mirror. c. Plane mirror. d. Concave lens.

24. The focal length of the mirror is the distance between

a. the centre of curvature of the mirror and its pole.

b. the centre of curvature of the mirror and any point on its surface.

c the focus of the mirror and any point on its surface.

d. the focus of the mirror and its pole.

25. The focal length of a spherical mirror equals .... radius of curvature.

a. double b. half c. quarter d. four times *(Cairo 2017I Sohas 2020)*

26. The distance from the centre of mirror curvature and its focus equals

a. radius of curvature. b. quarter of the diameter of curvature.

c. diameter of curvature. d. half of the focal length.

27. A concave mirror of focal length 5 cm, its diameter of curvature equals

a. 5 cm. b. 10 cm c. 15 cm. d.20 cm..

28. A concave mirror was cut from hollow spherical glass ball of diameter 16 cm. its focal length is .....

a. 8 cm. b.6 cm. c.4 cm. d.2 cm

29.A spherical mirror whose radius is 60 cm, its focal length is equal to *(Damietta 2016/ Sohag 2019)*

a. 30 cm. b. 120 cm. c. 60 cm. d. 90 cm.

30.A concave mirror has a focal vertex (length) of 10 cm, the radius of curvature of its surface equals *(Sharkia 2017 North Sinai 2018)*

a .5 cm. b.10 cm. c. 20 cm. d.40 cm.

31. A concave mirror with a focal length of 20 cm, and the object is placed at a distance of 50 cm from the mirror, the image is formed at a distance.........

a. more than 40 cm. ... b. more than 20 cm, and less than 40 cm.
c. equals 20 cm. d. equals 60 cm.

32. A concave mirror focal length 10 m. to form a virtual image for a body, the body should be placed at ....from the mirror

a. 10 b.I5 cm c.20 cm d. 5 cm

33. A concave mirror of Real length 10 cm, to form an equal image to a body, the body should be placed at from the mirror at .... from the mirror

a. 5cm b.10 cm c.15 cm d. 20 cm

34. A concave mi mirror has a focal length of 8 cm, an object is placed in front of this mirror forming an image at a distance 20 cm from the mirror, this means that the object is placed at ....from the mirror

a. 8m. b. less than 8 cm
c.20 cm d more than 8 cm and less than 16 cm.

35. If a light ray falls on a spherical mirror as shown in the figure, so it reflects by an angle equals.

a. zero b.45° c.90 ° d. 30

F
C

36. In the opposite figure
Radius of mirror curvature =......cm

a. 3 b.6 c.9 d. 12

3cm

37. In the opposite figure, an object is put in front of a concave mirror, a virtual upright mage object magnified image is formed. What is the focal length of the mirror ?

a. 2 b.3 c.4 d. 6

image
object
6 5 4 3 2 1 1 2 3 4 5 6

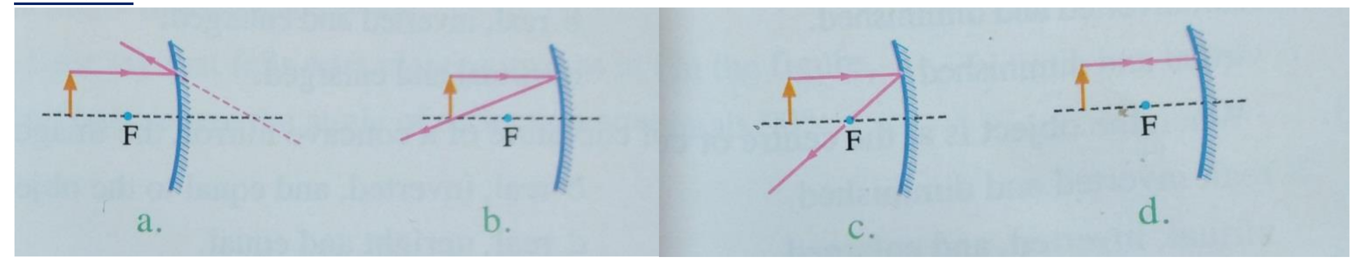
38. Light rays coming from the Sun are

a. convergent b. parallel.. c. divergent. d. reflected.

39 The incident light ray at a point on the surface of a concave mirror reflects, where the angle of incidence.........

a. equals the angle of reflection b. is more than the angle of reflection.
c. double the angle of refraction d. is smaller than the angle of refraction.

40. Which of these figures represents the correct path of the reflected rays from I concave mirror?



41. If a light ray falls parallel to the principal axis of a concave mirror it reflects….

a. passing by the spherical centre of the mirror *b. passing by the focus.*
c ,on itself *d. passing by the optical centre.*

42. If the light ray falls passing through the focus of the concave mirror, it will …….

a. reflect parallel to the principal axis *b. reflect on itself.*
c. reflect through the centre of curvature *d. there is no correct answer.*

43. When the object is very far from a concave mirror. …… image is formed.

a. very tiny *b. magnified* *c. real* *d. (a) and (e) are correct*

44. If a body is put at a distance less than the focal length of a concave mirror, the formed image will be

a. real, inverted and diminished. *B. real, inverted and same size as the object*
c. real, inverted and magnified. *d. virtual, upright and magnified.*

45. When the object is placed at the centre of curvature of a concave mirror the formed image is real, inverted and. ………….

a. diminished *b. equal* *c. magnified.* *d. very tiny*

46. A body is placed in front of a concave mirror at a certain distance from its pole, no image is formed on the screen, that is because the body is……

a. placed at infinite distance in front of the mirror.
b. placed at a distance less than focal length of the mirror.
c. placed at a distance more than the double of the focal length of the mirror.
d placed at a distance equals the double of focal length.

47. If the focal length of a concave mirror equals 10 cm, to obtain a virtual image, the body is placed at a distance from the mirror pole that equals……. .

a.10 cm *b. 15 cm.* *c. 20 cm.* *d.5 cm.*

48. A concave mirror whose radius of curvature is 50 cm, an object is placed at a distance that equals…….. to form a virtual, erect and magnified image for the object.

a. 12 cm *b.35 cm.* *c.25 cm* *d.50 cm.*

49. An object was put at 10 cm from a concave mirror, a real, inverted and equal image was formed, if the object moved 3 cm towards the mirror, so the formed image will be …

a. real, inverted and diminished. *b. real, inverted and enlarged*
c. virtual and diminished. *d. virtual and enlarged..*

50. When the object is at the centre of curvature of a concave mirror, the image is ….

a, real, inverted and diminished *b. real, inverted, and equal to the object.,*
c. virtual, inverted, and enlarged. *d. real, upright and equal.* *(Alex 2018)*

51. The spherical mirrors are used in ..

a medical glasses. b. telescopes.
c. marine lighthouses d. computers.

52. The optical piece which forms a virtual, erect and diminished image is …(Dakahlia 2015

a. convex lens b. plane mirror. c. convex mirror d. concave mirror.

53. From the properties of the image formed by a convex mirror is …) (Ismailia 2019)

a. virtual. b. real. c. upright. d.(a) and (c). ……

54. When an object is placed to face a convex mirror, the formed image (Dukahlia 2019)

a. lies behind the mirror. b. is real.
c. is erect. d. (a) and (c).

55. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror, so the length of the formed image becomes . (Cairo 2018 Luxor 2019)

a. 16 cm. b. 8 cm. c. 4 cm. d. less than 4 cm.

2. Choose from column (B), what suits it in column (A)

	(A)	(B)
	The position of the object related to the concave mirror	The properties of the formed image
1	1. The double of the focal length	a. Virtual, erect and magnified
2	2. Very far	b. Real, inverted and larger than the object
3	3. Larger than the double of the focal length	c. Virtual, erect and equal to the object
4	4. Between the centre of curvature and the focus	d. Real and very tiny
5.	5. Less than the focal length	e. Real, inverted and equal to the object
		f. Real, inverted and smaller than the object

3. Correct the underlined words :

1. The bouncing of the light ray in the same medium when it meets a reflecting surface is expressed by the light refraction phenomenon.
2. Light rays is passing when falling on reflected surface.
3 The incident ray is the light ray that bounces from the reflecting surface.
4 If the angle between the incident light ray and the reflected light ray on a plane mirror equals 140° so the incident angle equals 40°.
5. If the angle between the reflected light ray and the reflecting surface equals 40, he angle of incidence = 40°
6. A light ray that falls on a plane mirror as in the figure, it reflects where the angle of reflection equals 90°
7. When the light ray falls by an angle of 30° on the reflecting surface, so the reflected will be perpendicular on the reflecting surface.
8. The distance between the object and a plane mirror is more than the distance between the plane mirror and the image. (Cairo 2015-Port Said 2019)
9. The image which is formed by the plane mirror is real and inverted.

10. The word ambulance is written on ambulance cars <u>minimized</u>. (Beni Suef 2019)
11. When the angle between the incident light ray and the reflecting surface is 30°, the angle of reflection is <u>30°</u>,
12. The image of the object that is formed by the <u>convex</u> mirror is always virtual, erect ad equal to the object. (Kalyoubia 20 (Damietta, Luxor 2017/
13. If a person stands at 2 m from a plane mirror, so the distance between the person and his image is <u>6 m</u>.
14. The <u>focus</u> is the point that is in the middle of the reflecting surface of.
15. The focal length of the spherical mirror is the distance between the focus and the <u>centre of mirror curvature.</u>
16. If the radius of curvature of a concave mirror equals 20 cm, its focal length will be <u>30 cm.</u> Cairo 2019)
17. The <u>secondary axis</u> of the spherical mirror is the straight line that passes by the pole of the mirror and its centre of curvature.
18. The image of the object that is formed by the <u>converging mirror</u> is always, upright and laterally inverted.
19. The concave mirror is called <u>diverging</u> mirror.
20. In the spherical mirrors the radius of curvature of the mirror= the focal length <u>x½</u>
21. A spherical mirror whose diameter is 40 cm, so its focal length equals <u>40 cm.</u>
22. A spherical mirror whose diameter is 12 cm, its focus lies at a distance <u>6 cm</u> from the pole.
23. A concave mirror of a focal length 10 cm, so its radius of curvature= <u>5 cm.</u>
24. <u>Virtual image</u> can be received on a screen.
25. The <u>real</u> image is the image that cannot be received on a screen.
26. The light ray which is incident parallel to the principal axis of a concave mirror, reflect passing by the <u>centre of curvature of its face</u>. Men 20 l2
27. The incident light ray of the concave mirror that passes through the focus, reflects <u>of itself</u>
28.The light ray that falls on a mirror passing with its centre of curvature, reflects <u>passing through the focus.</u>
29. If you put a lighted body at a distance of 17 cm from a concave mirror, its focal length equals 20 cm, so the image is formed <u>in front</u> of the mirror.
30. If an object is put in front of a concave mirror at the <u>focus</u>, the formed image is real. inverted and equal to the object.
31. When putting a body on a distance of 16 cm from a concave mirror its focal length is 12 cm, then the image formed will be <u>virtual upright</u> and magnified image.
32. When an object is put between the focus and the centre of curvature of a concave mirror, the formed image is <u>virtual, upright and equal to the object</u>. (
33. When an object is put at a distance greater than the radius of curvature of a concave mirror, the formed image is real, inverted and <u>enlarged</u>.

34. When an object is placed at <u>the centre of curvature</u> of a concave mirror, its formed image is real, inverted and enlarged.

35. When the object is at the centre of curvature a concave mirror, the image is real, inverted and enlarged. (Dakahlia 2017,2019 New Valley 2016)

36. The image of the object that is formed by <u>converging</u> mirror is virtual, erect and equal to the object. (Red Sea 2018)

4.Write the scientific term of each of the following:

1. • The change in the direction of light ray in the same medium, when it falls on a reflecting surface.

2. Angle of incidence = Angle of reflection. (Assiut 2018 /Sohag 2020

3. The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface. (New Valley 2018/ Port Said 2019)

4. The light ray that falls on the reflecting surface.

5. The light ray that bounces from the reflecting surface.

6. The angle between the incident light ray and the line perpendicular on the reflecting surface. (South Sinai 2011/Cairo 2019)

7. The angle between the reflected light ray and the line perpendicular on the reflecting surface from the point of incidence. (Giza, Aswan 2018)

8. A mirror which gives laterally inverted and equal size image for an object. (Cairo 2015/ Fayoum 2016)

9. A mirror which is a part of a hollow sphere. (Suez 2019)

10. A mirror whose reflecting surface is the inner surface of a sphere and converges the light rays. (Alex. 2017/ Sharkia 2019)

11. A mirror whose reflecting surface is the outer surface of a sphere and diverges the (Kalyoubia 20106/ Behira 2019

12. A mirror always forms a diminished image for the object. (Giza 2019/ Sharkia 2020

13. •A point that is in the middle of the reflecting surface of the spherical mirror. rays

14. • The distance between the pole of the mirror and its centre of curvature.

15. The straight line that passes by the pole of a spherical mirror and its centre of curvature (Kafr El-Sheikh 2019/ Menofia 2020 (Gharbia 2016)

16. The centre of the sphere that the mirror is considered as a part of it.

17. The straight line that passes by the centre of curvature of the mirror and any point on its surface except the pole of the mirror. (Matrouh 2018/Red Sea 2020

18. The point of collection of the parallel rays after being reflected from the mirror.

19. The distance between the pole of the mirror and its focus.

20. Light rays produced by a distant (far) object.

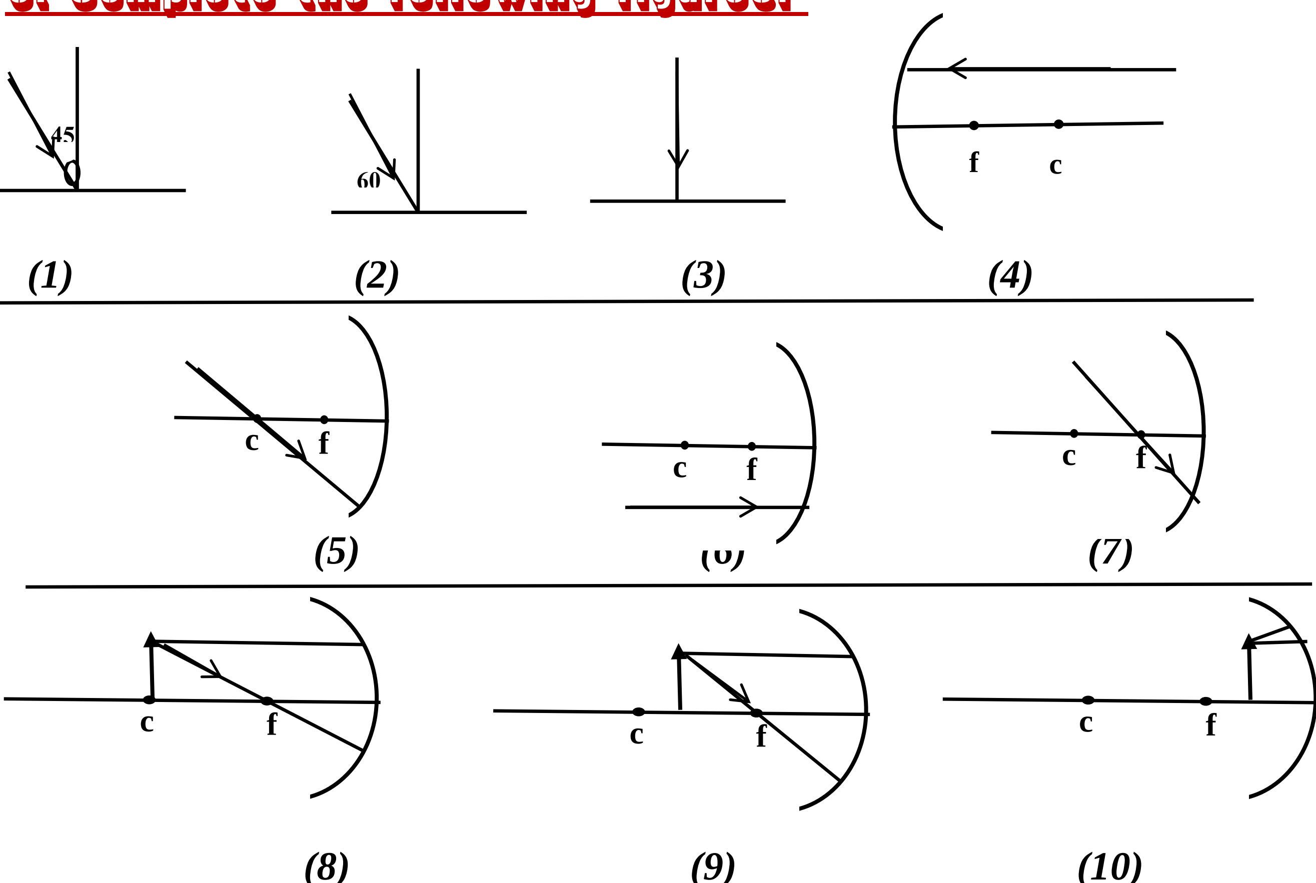
21. The scientist who used the way of concentrating the Sun rays to destroy the Roman fleet in 212 B.C. (New Valley, Menia 2019

22. The image that can be received on the screen. (New Valley 2018)

23. • The image that cannot be received on the screen. (Dakahlia, Menofia 2020)

24. A mirror used to get virtual, upright and magnified image for the object.
25. The spherical mirror which forms virtual, upright and small image for the object, wherever its position in front of the mirror.
26. A light piece of reflecting surface forms a real, inverted and enlarged image.

5. Complete the following figures:



6.Give reasons for:

1. •When you look at a mirror, you see your face image. (Suez 2019)
   • The human being noticed that when he looked at the still water surface, he could see the image of his face in the water. (Sharkia 2020)
2. The perpendicular incident light ray on a plane mirror reflects on itself. (Sohag, Red Sea 2019)
3. The angle of reflection of a light ray falls perpendicular on a plane mirror equals zero. (Dakahlia 2019)
4. The image formed by a plane mirror is virtual.
5. The image formed by a plane mirror can't be received on a screen. (Menia 2020)
6. The word AMBULANCE is written in a laterally inverted (reversed) way on the ambulance car. (Fayoum 2018/ Qena 2019)
7. • When you look at a plane mirror, you find that you hold the pen by the left hand which is inverse the real position.
   • Most of people can't write in a correct way, while they are seeing their writings through a plane mirror.
8. The spoon made of silver is a spherical mirror. (Port Said 2016)

9. The concave mirror is called converging mirror, while the convex mirror is called diverging mirror.
10. The spherical mirror has only one principal axis and uncountable number of secondary axes.
11. Concave mirror is used to generate high heat energy. (Behira 2016) (Dakahlia 2020)
12.The focal length of a concave mirror can be determined by knowing its radius of Curvature. (Cairo 2018, 2020)
13.The incident light ray on a concave mirror passing through the centre of curvature reflects on itself. (Luxor 2014)
14. No image is formed for an object, if it placed at the focus of a concave mirror explain with drawing).
15. The focus is virtual by the convex mirror.
16. The image formed by a convex mirror is always virtual. (Beni Suef 2014/ Alex. 2018)
17. The image formed by the convex mirror cannot be received on a screen, .
18. A convex mirror is put at the left side of the driver of the car
19. The real image can be received on a screen, while virtual image cannot,

7.What is meant by ... ?

1. Light reflection phenomenon. (Assiut 2019/ Cairo 2020)
2. The angle of incidence on a reflecting surface is 60°.
3. The angle of reflection of a light ray on a mirror is 30°. (Alex. 2017Qena 2020)
4. The angle of incidence of a light ray on a plane mirror = zero. (Dakahlia 2017/ Luxor 2018)
5. The image formed by a plane mirror is virtual. (Ismailia 2012)
6. The radius of curvature of a convex mirror is 8 cm. (Red Sea 2015/ Alex 2019)
7. The focal length of a concave mirror = 10 cm. Sharkia 2018 Port Said 2019)
8. The distance between the principal focus of a spherical mirror and its pole is 20 cm. (Giza 2018 / Gharbia 2020) -

8. What happens when... ?

1. The angle of incidence of a light ray increases from 20° to 50°
2. A light ray falls perpendicular to a plane mirror. (Luxor 2016)
3. A light ray is incident by an angle 35° on a plane mirror.
4. A light ray that falls on a plane mirror as in the opposite figure. (Sohag 2018) (South Sinai 2016)
5. The body becomes closer to the mirror (concerning : the distance between the image and the plane mirror]. (Kalyoubia 2019)
6. A light ray is incident on a concave mirror passing through its focus. (Luxor 2015)
7. Incidence of a light ray parallel to the principal axis of a concave mirror. (Cairo 2019 Beni Suef 2020)
8. The incident light ray passes through the centre of curvature of the concave mirror. (Menia, Sohag 220)
9. A body is placed at the double focal length of the concave mirror(Sohag, New Valley 2016)

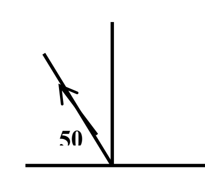
10. • An object is placed between the focus and the pole of a concave mirror.
11. Placing an object between the focus and the centre of curvature of a concave mirror. (Beni Suef 2015)
12. A body is placed in front of a convex mirror.
13. A plane mirror is put on the left side of the driver of the car instead of a convex mirror. (North Sinai 20N Kafr Sheikh 2019) (Mina Red Sea 2020)

9. Problems :

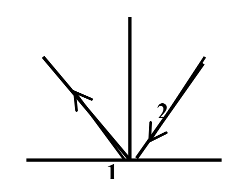
1. Sun ray is incident on a concave mirror the image that is formed was real, very small at a distance 2 cm from the reflecting surface of the mirror. *The same mirror used w obtain real, inverted and magnified image for another object, draw the path of ray in the second case then* **calculate** *the distance between the object and the mirror.*
2. If the angle between the incident ray and the reflected ray is 140°, find the angle of incidence and the angle of reflection.
What is the relation between them ? (Aswan 2015 Sohag 2016. 2017)
3. If the angle between the incident light ray and the reflected light ray on a plane mirror equals 120°, Answer the following questions :
a. Calculate the angle of incidence. (Kafr El-Sheikh 2015 I Cairo 2017)
b. Calculate the angle between the incident ray and the reflecting surface.
4. If a person stands at 3 m from a plane mirror. Answer the following questions:
a. What is the distance between the person and his image ? Assiut 2017/ North Sinai 2018)
b. Write four properties of this image. (Dakahlia 2018)
5. A person stands in front of a plane mirror at a distance of 10 metres.
What is the distance he must move, so that the distance between him and his image can become 6 metres ?
6. Find the focal length of a concave mirror that its diameter is 20 cm.

10.Study the following figures and answer the following questions :

1. (a) The value of angle of reflection is ......
(b) Define : the angle of incidence .

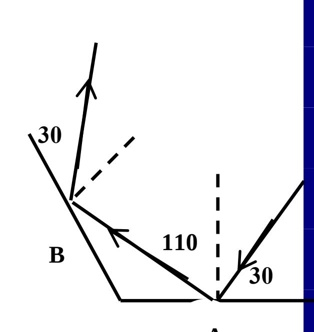


2. In the opposite figure : *(Assiut 2019)*
An incident light ray falls on the plane mirror ,
calculate the value of the reflected angle ?





3. In the opposite figure :
(a) Mention the number that represents the angle of reflection
(b) What is the relation between the two angles ?(Giza 2016)



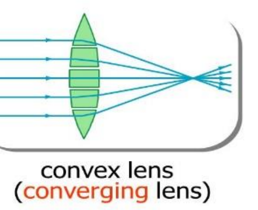
6. The opposite figure *shows two plane mirrors (A) and (B)*
.If a light ray falls on the mirror (A) and reflects in the mirror (B) as in the figure. Calculate each of the following
(a) The angle of incidence of the light ray on a mirror (A).
(b) The angle of reflection of the light ray from the mirror (B)
(c)The angle between the two mirrors.

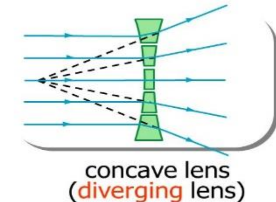
Chapter (2) Lenses

Lens It is a transparent medium that refracts the light and is defined with two spherical surfaces and is usually made of glass or plastic

1 Convex and concave lenses

Converging or Diverging?


convex lens (converging lens)


concave lens (diverging lens)

Uses of lenses

1- In medical eyeglasses *for reading or walking*



2- In telescopes to *form enlarged and near images for the celestial bodies*



3- In microscopes *to form magnified images for the tiny bodies that cannot be seen by naked eye*



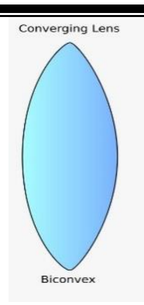
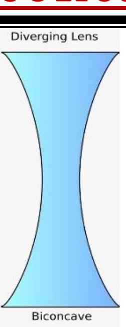
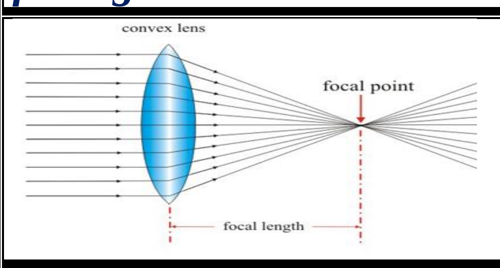
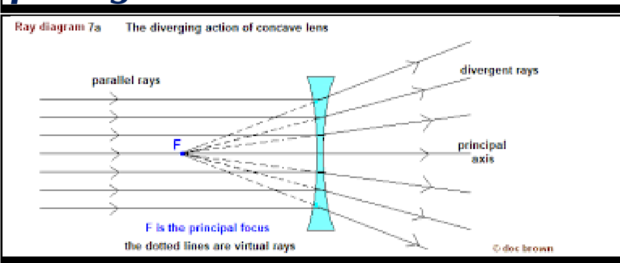
4- In binoculars المنظار الحربي *to see the far object*



5- In magnifier lens *to see the minute parts*

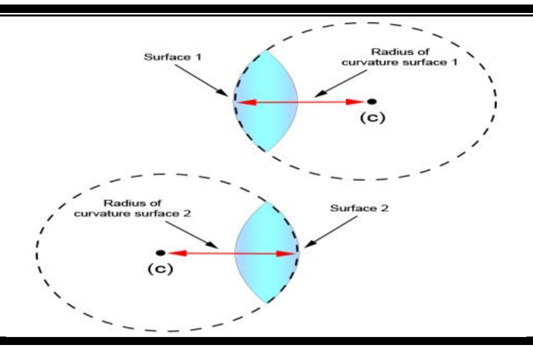
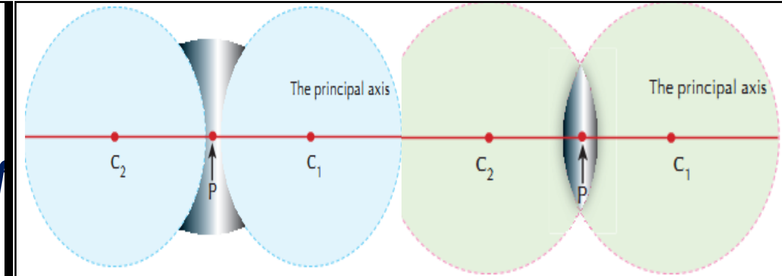
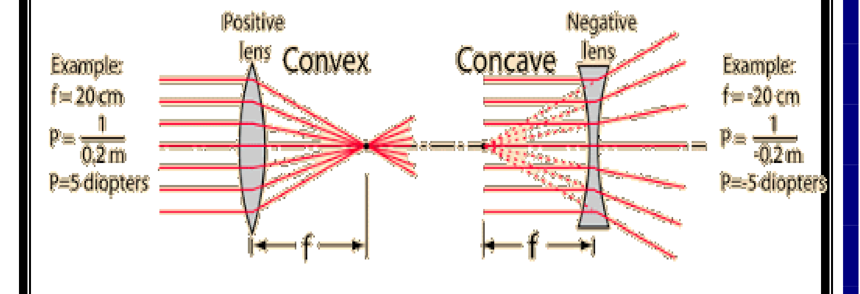
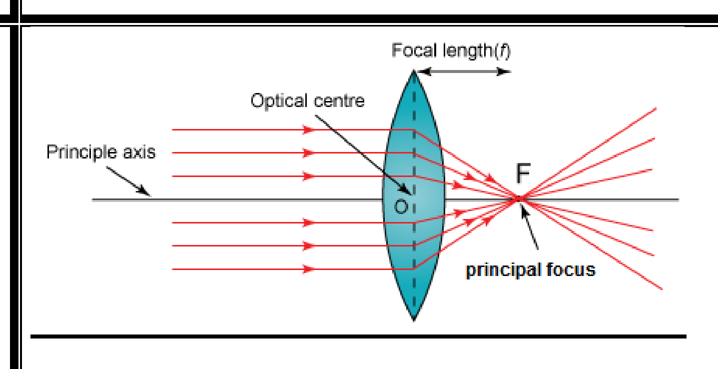


The types of lenses:

Convex lens (converging)	**Concave lens** (diverging)
	
It is a transparent optical piece which is thick at the centre and less thickness at the tips.	It is a transparent optical piece which is thin at its centre and thicker at the tips.
it is called **converging** lens **G.R.?** ? Bec. it **Collect** *the light rays falling on it*	it is called **diverging** lens **G.R.?**? Bec. **diverge** *the light rays falling on it*
	

Identify the following concepts:

Concept	Definition	Figure
1-The centre of curvature of the lens face (C):	*Is the centre of the sphere where this face is a part of it.(C1, C2)* *The lens has two center*	
2-The optical centre of the lens (p)	*Is a point inside the lens lies on the principal axis in the mid distance between its faces.*	

3 -The radius of curvature of the face of the lens (p)	*It is half the diameter of the sphere where this face is a part of*	
4-The principal axis	*Is the line between the two centres of the lens passing by the optical centre of the lens* *The lens has only one principal axis*	
5-The focus of the lens (F) (principle focus)	*it is the point collection of the reflected light rays (in the convex lens)or their extension in (concave lens)*	*real in case of the convex lens on front of the reflecting surface* *virtual in case of the concave lens behind the reflecting surface* 
6- focal length of the lens (F)	*It is the distance between the **principle focus** of lens and the optical center of the lens* *f= 1/2 R*	

First: The convex lens

Activity The focus and focal length of the convex lens (converging):





Materials: *A convex lens - screen - lens holder - distance source of light (can use the sun ray)*

The steps *1-Place the lens on a holder where the distance light source is facing one its faces.*

2 -place a horizontal screen on the other side of the lens and move it closer and farther from the lens until you get the lit point which is the (focus of the lens

3-Measure the distance between this point and the optical centre of the lens which is **the focal length (f) of the convex lens.**

The path of rays falling on the convexe lenses

The path of the incident ray	The path of the reflected ray	Explanation Figure
The incident light ray passing through the optical centre of the lens continues	*pass inside the lens and passes without refraction*	
The incident light ray parallel to the principal axis, of the lens	*exits the lens passing through the focus*	
The incident light ray passing through the focus,	*exits the lens parallel to the principal axis*	

The Properties of the image formed by the convex lenses

Position of the body	Characteristics of the images	cases of image formation	Position of the image
very far	-Rea -inverted -very tiny (dot)		at the focus
More than twice the focal length	1-Real 2-Inverted 3-Smaller than the object		Between the focus and twice the focal length
At twice the focal length	1-Real 2-Inverted 3- equal to the object		At twice the focal length
Between the focus and twice the focal length	1-Real 2-Inverted 3-enlarge		At a distance large than twice the focal length
At the focus	No image is formed		
At a distance smaller than the focal length	1-Virtual 2-upright 3- enlarge		in front of the lens at the object side

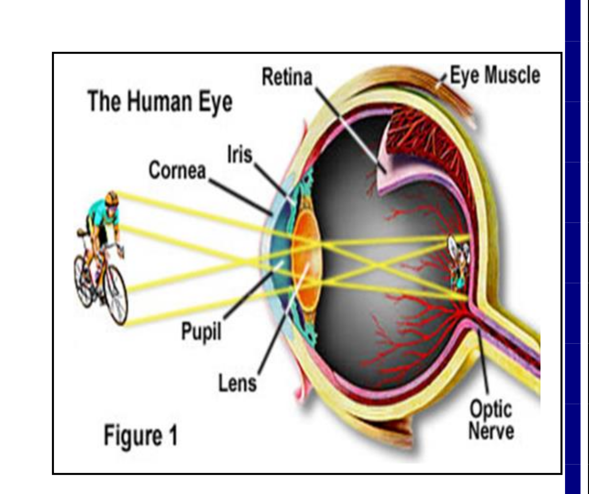
The image formed by the concave lens:	1-virtual 2- erect 3- smaller.	Object, Image, 2F2, F2, F1, 2F1, Biconcave lens	In the same side of the object

G.R. The concave lens is also known in this case as the diverging lens?

Because it diverges the rays after they pass through it.

The vision

The use of lenses to treat the vision defects



The most important of the vision defects:

Short-sightedness – long-sightedness.

The vision occur

The light rays reflected from the body to fall on the eye, then refract when pass through cornea then the eye convex (lens)

The refracted rays fall on the retina forming (real, inverted and diminished image)

G.R. vision defects occur?

Because the eye cornea is not always convex, or the eye is not always spherical.

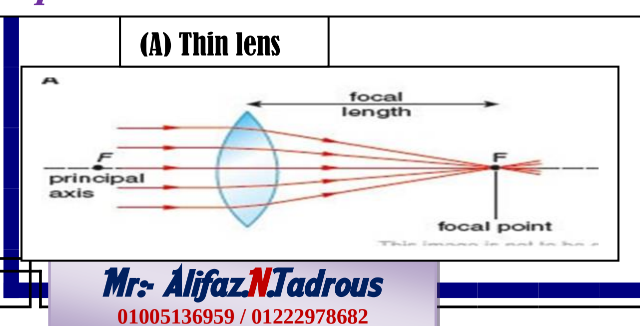
The normal person can see clearly

The far objects at distance up to **6m**

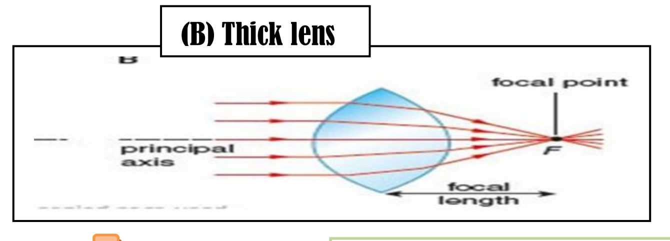
The near objects at distance = **not less** than **25 cm**

It has a **large** *focal length* *The reason* *As the* **convexity** *of its lens face is* **small** *so. the focus is* **farther** *to the optical centre*	*It has a* **small** *focal length* *The reason* *. As the* **convexity** *of its lens face is* **large** *se the focus is* **nearer** *to the optical centre*

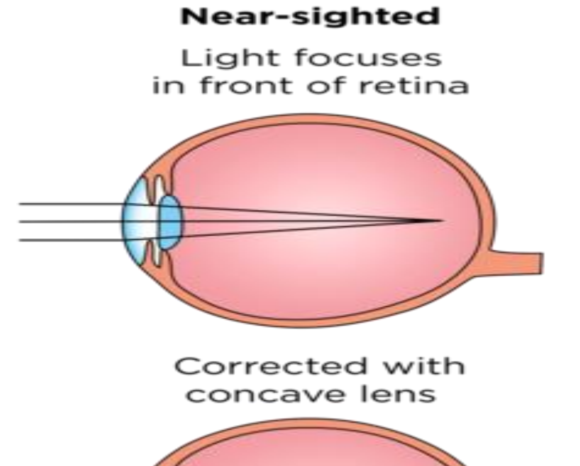
(A) Thin lens

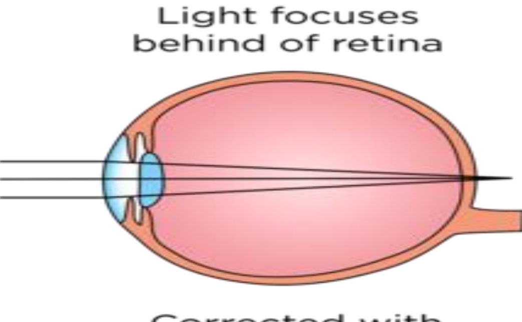


(B) Thick lens



Short-sightedness	Long - sightedness
It is a vision defect through which near objects can be seen clearly but far objects seems distorted مشوه	*It is a vision defect through which far objects can be seen clearly but near objects seems distorted*
	
causes **1- increase the diameter of eyeball** *this causes the retina to be far from the eye lens* **2- increase the convexity of the eye lens surface** *this causes a shorter focal length for eye lens*	**causes** **1- Decrease the diameter of eyeball** *this causes the retina to be close to the eye lens* **2- Decrease the convexity of the eye lens surface** *this causes a longer focal length for eye lens*
Lead to *the light rays coming from far object are collected at point In front of the retina (unclear)*	**Lead to** *the light rays coming from near object are collected at point Behind the retina (unclear)*
Correction By using a **concave lens** **G.R.** *Because it diverge rays coming from the far object so the image formed on the retina*	**Correction** By using a **convex lens** **G.R.** *To collect the rays coming from the near objects so the image formed on the retina*





Contact lenses:



1-It is very thin lenses made of plastic, and can stick to the eye cornea by the eye fluid
2-It is used instead of the glasses.



Cataract

Cataract is one of the most dangerous diseases that infect the eye

The effect Cataract diseases causes difficulty of vision as a result of darkness of the eye lens

The reason of Cataract diseases

1- Old age
2- illness
3- Side effects of drugs
4-genetic readiness.

The Treatment of Cataract

Is done through surgery to exchange the eye lens with a plastic lens transplanted permanently in the eye. In this way, the person can see again and clearly.

Land area measurement



Land surveyors and topographical scientists use a mirror provided with later ray to determine heights and distances and to make very accurate measurements to calculate the time that a light beam bounced from a distant point and returns to its source.

Position of the object	Characteristics of the images	The cases of image formation of mirror	cases of image formation
very far	–Real - inverted - *very tiny (dot)* – at the focus		
At a distance larger than the radius of curvature.	–Real - inverted - *small than the object* Between the focus and the center of curvature		
At the centre of curvature of the mirror. Or lens	Real - inverted – *Equal the object* At the center of curvature of the mirror.		
Between c And (f).	Real - inverted – *larger than object* At a distance greater than the radius of curvature		
Between (f) and (p).	virtual - upright – *larger than object* – (magnified) Behind the mirror		
The formation of the images on a convex mirror Or concave lens	The images of the object in front of a *convex mirror* is always virtual - upright – *smaller than* the object,(not received on a screen)		

Unit two Lesson two

1- Choose the correct answer:

1. Lenses used in the………..

a. cameras. b .medical glasses. c. binoculars d. all the previous things..

2. Concave lens is called……….. lens.

a. diverging b. converging c. collecting d. no correct answer

3. The convex lens..

a. is thin at the centre and more thickness at the tips.

b. is thick at the tips and less thickness at the centre.

c. is collects the light rays falling on it d is diverges the light rays falling on it.

4. The straight line that joins between the two centers of curvature of the lens and passes through its optical centre is called. …………

a the focal length. b. the principal axis.

c. the secondary axis. d. the radius of curvature.

5. To determine the focal length of a lens, the mathematical relationship. …….can be used.

a. $f=\frac{r}{2}$ b. f= rx2 c. $f=\frac{2}{r}$ d. $f=\frac{1}{4}r$

6. From the opposite figure, the radius of curvature is .

10 cm
F

a.5 cm. b. 10 cm.

c. 15 cm. d. 20 cm.

7. If the focal length of a concave lens is 6 cm, the radius of curvature equals……

a. 3 cm b. 6 cm c.9 cm d. 12 cm.

8. A convex lens, the distance between its focus and its optical centre is 10 cm, so the double of the focal length is

a. 10 cm b.20 cm c. 30 cm. d. 40 cm.. (Sohag 2018)

9. If the radius of curvature of a lens is 40 cm, its focal length equals..

a. 5 m. b. 10 cm. c. 20 cm. d. 50c m.

10. If the distance between the two centers of curvature of the lens is 20 cm. this means that the focal length is (Kalyoubia 2018 Beni S 2010)

a. 5 cm b. 10 cm. c. 15 cm d. 20 cm .

11. The distance is ………..the focal length of the lens

P
Object
F
Q
R
S
Image

a. PQ b.PS

c. QR d. QS

12. The convex lens which has great thickness from the following its focal length is ….. in

a.4 cm b. 6 cm c. 8cm d. 10 cm

13. If a light ray falls passing through the optical centre of the convex lens it leave the leas

a. passing through the focus b. parallel to the principal axis

c. without refraction d. no correct answer

14. If a light ray falls on a convex lens and passing through its focus it……,

a. passes in a straight line without deviation b. refracts parallel to the principal axis

c. passes from the optical centre in a straight line d. no correct answer

15.A convex lens with a focal length of 20 cm, and al object was placed 40 cm from the lens, the image of the object is formed at ....

a. 40 cm. *b. 20 cm* *c.10cm* *d. 5cm*

16. A convex lens its focal length of 20 cm, put a body at a distance more than the double of in focal length, the formed image is real, inverted and small at a distance ......cm

a. 5. *b. 8* *c.10* *d. no correct answer*

17. Which of these figures represents the correct image formed by a convex lens? .....

Object — Image — a.
Object — Image — b.
Object — Image — c.
Object — Image — d.

18. The optical piece that forms an equal, laterally inverted image of the body is the.

a. spherical mirror. *b. plane mirror.*

c. convex lens. *d. concave lens.* *(Kalyoubia, Aswan 2018)*

19. The optical piece which forms virtual, upright and diminished image of the body is

a. convex mirror. *b. plane mirror.* *c. convex lens.* *d. concave mirror.*

20. When the object is at the centre of curvature of the lens (C), the image is formed at a distance ....the radius of curvature. *(Behira 2017)*

a. equals to *b. greater than* *c. smaller than* *d. no correct answer*

21. An object When a placed at a distance less than the focal length of the convex lens, the porosities of the image formed are ......

a. real invented and enlarged *b. a. real invented and smaller*

c. virtual, upright and enlarged. *d. no correct answer*

22.An object is placed at the focus of a convex lens, the image will be formed ..

a.. between the focus and the centre of curvature.

b. at the centre of curvature.

c. not formed. *d. no correct answer*

23. If an object is put at a distance greater than the double of focal length image is formed

a. between the focus and the centre of curvature *b. at the double of focal length*

c. at infinity *d. in front of the lens in the same side.*

24.If an object is placed at a distance more than the twice of the focal length from convex lens its focal length 5 cm and the image which formed is an inverted, real and smaller at a distance .... cm.,.

a. 3 *b. 5.* *c. 8.* *d. 10*

25. On putting a torch in front of a convex lens at a distance equals its focal length. the light rays emerged from the lens are ....

a. parallel *b. diverged.* *c. converged.* *d. no correct answer.*

26. A convex lens has a focal length of 50 cm an object is placed at a distance of 80 cm from the lens, the image of the object is formed at a distance of ....

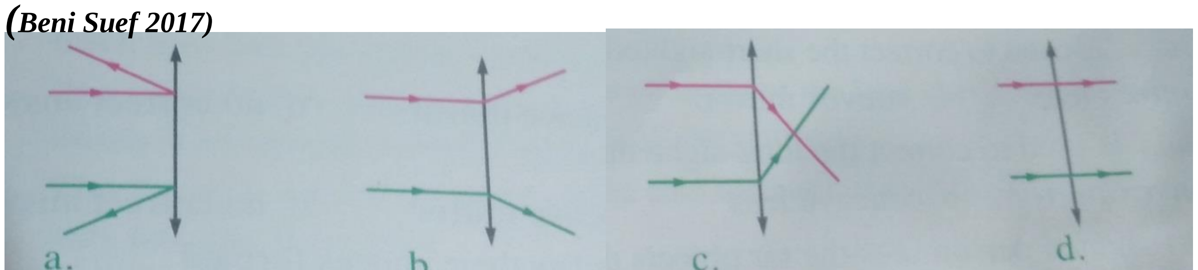
a. greater than 100 cm. *b. equals 100 cm.*

c. equals 50 cm. *. d. no correct answer.* *(Menofia 2016Kafr El Sheikh 2019)*

27. A lens is placed in the passage of Sun rays, a very small image for the Sun is formed at a distance 20 cm from the optical centre of the lens, if this lens is used to form a real. inverted and enlarged image for another body. What is the distance between the body and the optical centre of the lens ? .

b. 20 cm. c. 30 cm. d. 40 cm. a. 10 cm.

28, Which of the following figures represents the correct path of rays through the convex lens ? *(Beni Suef 2017)*



29. An object is placed at 80 cm from a convex lens of focal length 20 cm. The image of the object is formed at a distance……..... cm from the lens. *(Qena 2018)*

a.30 b. 50 c. 100 d. 133

30. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror so the length of the formed image becomes ……….

a 16 cm b. 8 cm c.4 cm d. less than 4cm

31. The virtual image is always formed by the

a. a plane mirror. b. convex mirror .
c. concave lens d. all the previous answer

32. The virtual-upright magnified image formed in case of ……….

a. concave lens. b. convex mirror
c. plane mirror. d. concave mirror and concave lens

33. The ratio between the body length and its image formed by a concave lens ……one

a. more than b. less than c. equal to d. no correct answer

34. The image formed by using a concave lens is…… *(Cairo 2019*

a. real, inverted and enlarged. . b. virtual, upright and diminished.
c. virtual, upright and diminished d. virtual, upright and enlarged

35. The image formed by ………is always virtual, erect and small.

a. convex lens b. concave mirror
c. plane mirror d. convex mirror and concave lens

36. The person with normal vision sees the object clearly at a distance not less than

a. 25 cm. b. 20 cm. c. 15 cm. d. 10 cm. *(South Sinai 2010/ Sharkia 2019)*

37. Vision defects occur because……..

a. the eye lens is not always convex. b. the eyeball is always spherical.
c. the eye ball is not always spherical d. (a) and (c). .

38. Short-sightedness person is the person who

a. sees the far only objects clearly. b. sees the far and near objects unclearly
c. sees the near objects only clearly d. can't see neither far nor near objects.

39. In short-sightedness....

a. the images of the near objects is formed behind the retina b. the eyeball diameter is large.
c. the eyeball diameter is small d. no correct answer.

40. A …………… is used to correct the short-sightedness.

a. convex lens b. convex mirror c. concave mirror d. no correct answer

41. A ………. is used to correct the long-sightedness.

a. convex mirror b. concave lens c. concave mirror d. no correct answer

42. A short-sighted person sees the far objects distorted as their images formed …

a. on the retina. c. in front of the retina.
b. behind the retina. d. in front of the lens

43.The long sightedness leads to the collection of rays…….. the retina

a. on b. behind c. in front of d. below

44 The person who suffers from long-sightedness is treated by using ……….

a. a concave mirror b. a concave lens c. a convex lens c. a convex mirror

45.The short-sighted person needs a medical eye glasses with ……..lens.

a. a convex b. concave c. plane d. convex and concave

46. A doctor advised a person who has a sight defect to use glasses with convex lenses , it means that this person suffers from ………….

a. decrease in the convexity of the eye lens surface.
b. an increase in the convexity of the eye lens surface.
c. an increase in the eyeball diameter.
d. disability of seeing far objects clearly.

47.………………….. lenses are used instead of glasses.

a. Concave b. Convex c. Contact d. Converging

48. Contact lenses can stick to the eye ……..by the eye fluid.

a. retina b. cornea c. lens d. no correct answer

49. From the causes of cataract is

a. genetic readiness. c. effect of drugs. b. old age. d. all the previous answers.

2. Correct the underlined words:

1. The lens is a transparent medium that reflects the light and is defined with two spherical surfaces. Port Sad 2019
2. The concave mirror is a transparent medium that refracts the light and is limited with two spherical surfaces.
3. The types of lenses are concave and plane.
4. The concave lens is converging lens.
5. The concave lens collects the rays fall on it.
6. The concave lens converges the light rays that falling on its surface.
7. Each lens has one centre of curvature.
8. The straight line joining between the two centers of the lens curvature and passes through its optical centre is called radius of curvature.
9. The focus is a point inside the lens in the mid distance between its faces, the principal axis passing through it.
10. The incident ray that passes through the optical centre of the lens passes without reflection.

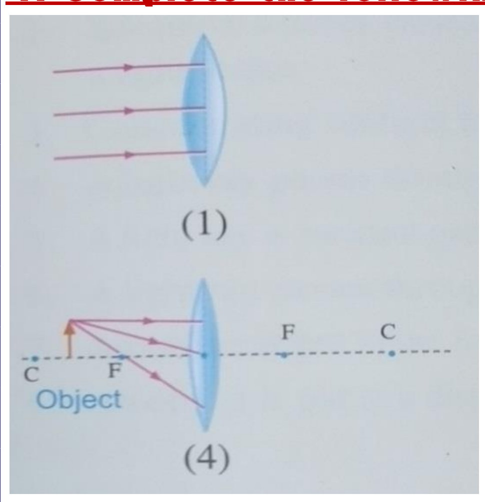
11. The incident light ray parallel to the principal axis, exits from the convex lens passing through ***the optical centre*** *of the lens.*
12. The properties of the formed images by the convex lens depend on ***the length*** *of the object from the lens.*
13. When you put an object at a distance 100 cm away from a convex lens whose focal length is 50 cm. It forms an image at a distance ***10 cm*** *away from it.*
14. The object that is placed at ***the twice of the focal length*** *of a convex lens doesn't an image of it.*
15. The focal length of the thin convex lens is ***equal to*** *the focal length of the thick convex lens.*
16. The formed image of an object that is put at ***the centre of curvature*** *for a convex lens virtual enlarged.*
17. A convex lens of focal length ***15 cm,*** *an object was placed at 40 cm from the lens, the formed image is real and equal to the size of the object.*
18. The optical piece which forms an equal, inverted image of the body ***is concave lens***
19. The image formed by the concave lens is always ***real, inverted*** *and small (diminished) image.*
20. The clear vision for a normal vision person remains, if the object comes closer at a distance not less than ***60 cm.***
21. Long-sightedness person can see the ***near*** *objects clearly, but close objects are not seen clearly.*
22. A concave lens is used to treat ***long-sightedness.***
23. The long-sightedness is due to the formation of the image ***in front*** *of the retina.*
24. The long-sightedness is corrected by using a ***concave mirror.***
25. The short-sightedness is treated by using a ***convex lens.***
26. The contact lenses can stick to the eye ***iris*** *and can be removed easily.*
27. ***Short-sightedness*** *is a disease of the eye lens, so it becomes dark.*

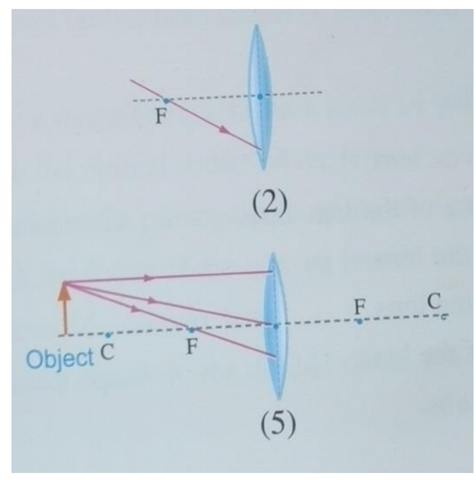
3. Write the scientific term of each of the following statements:

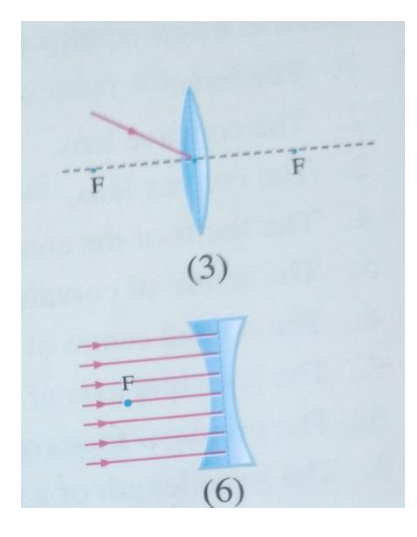
1. •A transparent medium refracts the light,
• A transparent medium that refracts the light and is defined with two spherical surfaces and is usually made of glass or transparent plastic.
2. The transparent optical piece which is thick at the tips and thin at the middle and diverges the light rays falling on it.
3. The optical piece that is thick at the centre and less thickness at the tips.
4. The point inside the lens on the principal axis in the mid distance between its faces.
5. Half the diameter of the sphere, where the face of the lens is a part of it.
6. The line joins the centre of curvature of the lens and its optical centre.
7. The straight line joining between the two centers of curvature of the lens and passing through the optical centre
8. The midpoint inside the lens, through which light rays pass without refraction.

9. Any line passes by the optical centre of the lens except the principal axis
10. The point of collection of the refracted light rays which is produced when the light rays tall parallel to the principal axis of a lens.
11. The distance between the focus and the optical centre.
12. The image which is formed due to the collection of the refracted rays and can be received on a screen.
13. The point of collection of the extensions of refracted rays by a concave lens
14. The lens used to form a virtual, upright and always diminished image for the
15. • Seeing the near objects clearly and seeing the far objects distorted. (Port Said 2016
• A vision defect is due to the formation of the image in front of the retina of the eye
16. An optical piece that is used to treat a vision defect which causes the formation of image in front of the retina. (Kalyoubia 2000)
17. • A vision defect in the eye due to the decrease in the convexity of the eye lens surface (Sharkia 2018/ Red Sea 2019) (Menia 2020)
•A vision defect results due to the formation of the image behind the retina of the eye.
• A vision defect results due to the decrease of the eyeball diameter.
18. The lens that corrects the short-sightedness.
19. The lens that corrects the long-sightedness.
20. A kind of lenses that is very thin and made of plastic and used instead of glasses and can stick to the eye cornea by the eye fluid. (Menia 2018/ Behira 2019
21. The material from which the contact lenses are made,
22. A disease infects the eye lens, so it becomes dark (opaque). (Kafr El Sheikh,

4. Complete the following figures:







5. Give reasons for :

1. The convex leas is called converging lens , while the concave lens is called diverging lens (New Valley2020)
2. The focal length of the thick convex lens is less than that of the thin convex lens
3. The lens has two centers of curvature ,
4. • The collective lens has two foci , but the collective mirror has one focus
• The lens has two foci , while the spherical mirror has one focus . Dakahlia 2019

5. The object that is placed at the focus of a convex lens has not an image,
6. A piece of paper can be burned by a convex lens.
7. • The image formed by the concave lens cannot be received on the screen.
• It is impossible to obtain a real image by using a concave lens .
8. Concave lens has a virtual focus .
9. Vision defects occur .
10. Short - sightedness person sees the far objects distorted .
11. Some persons have short - sightedness . (Cairo Matrouh 2019)
12. In short - sightedness , the retina is far from the eye lens .
13. Concave lens is used to correct short - sightedness person .
14. Occurrence of long - sightedness of the person .
15. Long - sightedness person cannot see the close objects clearly
16. The retina is close to the eye lens in the long - sightedness person .
17. The image of the near objects are formed behind the eye retina in the long - sightedness ,
18. The long - sightedness is corrected by using a convex lens .
19. The infection of the eye with the cataract .

6. What is meant by ... ?

1. The focal length of a convex lens is 15 cm .
2. The distance between the optical centre of a convex lens and its focus is 10 cm .
3. The radius of curvature of a concave lens is 20 cm
4. The image formed by the lens may be real or virtual .
5. The image formed by the concave lens is virtual ,
6. A person suffers from short - sightedness .
7. A person suffers from long - sightedness .

7. State one function (importance) for each of the following :

1. The convex lens (in eye's medicine field) .
2. The concave lens .
3. The contact lenses . South
4. Space telescope .

8. What happens when ... ?

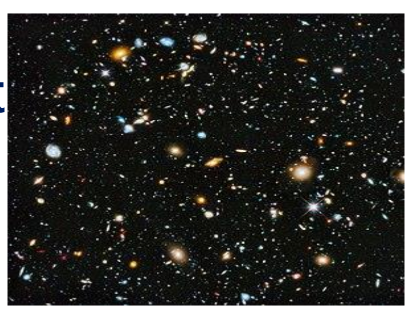
1. The radius of curvature of the face of the lens increases twice (concerning the focal length) .
2. You move a screen closed and farther from a convex lens when its other side is facing to a light source
3. Concentrating sunlight by a magnifying lens on a piece of paper .
4. A light ray passes through the optical centre of the lens .
5. A light ray is incident parallel to the principal axis of the convex lens .
6. A light ray passes through the focus of the convex lens .
7. An object is put at the focus of a convex lens .
8. An object is put at a distance equals to the double of the focal length of a convex lens .

9. You want to see a virtual, erect and magnified image of an object through a convex lens
10. Incidence of a beam of light rays parallel to the principal axis of a concave lens,
11. An object is put in front of a concave lens,
12. The eye lens surface in man is too (more) convex.
13. The eye lens surface in man is less convex.
14. • The length of the eye radius is larger than the normal.
• The diameter of the eyeball elongates.
15.• The diameter of the eyeball becomes shorter than a certain length..
• The shortness of the radius of the eyeball.
16. The infection of the eye with the cataract disease.

9. Show by drawing, the path and the directions of rays in the following cases:

1. The incident light ray passing through the optical centre of the lens.
2. The incident light ray parallel to the principal axis.
3. The incident light ray passing through the focus.
4. • A body is put in front of a convex lens at a distance of 30 cm, knowing that its focal length is 15 cm.
• The formed image by a convex lens to an object at a distance equals twice the focal length (at the centre of curvature of a convex lens).
• The formation of an image equals to the object by means of a convex lens.
5. • The formation of the image of a body is placed at a distance smaller than the focal length of a convex lens then mention the properties of the formed image.
• The eye sees the image of the object which is placed at a distance of 8 cm from a convex lens has a focal length = 12 m, then mention the properties of the formed image..
6. An object is put at the focus of the convex lens.
7. • The formed image by a convex lens to an object at a distance larger than the focal length and smaller than twice the focal length (mention the properties of the image). (Sharkia 2014/Giza 2017
• The formed image for an object located in front of a convex lens between the focus and centre of curvature.
• An object is placed at a distance of 30 cm from the convex lens, its focal length 25 cm (mention the properties of the image).
8. • An object was placed at a distance of 5 cm from a convex lens, its focal length is 2 cm (mention the properties of the image).
• The formed image by convex lens, when the body at a distance greater than double the focal length. Then write the properties of the formed image.
(Cairo 2019 Port Said 2020) (Menia 2010
9. • The eye sees the image of an object which is placed at a distance of 8 cm from a concave lens has a focal length 2 cm (mention the properties of the image) .

Unit (3)
Chapter (1)
The Universe and the Solar System
The Universe



Universe It is the wide and extended space that contains all the galaxies, stars, planets, moons and living organisms and everything

The universe is very vast

The Sun and the earth are tiny parts in the universe

The number of galaxies in the universe is about 100,000 million galaxies



The galaxy they are groups of stars that rotate together in cosmic space by the effect of gravity

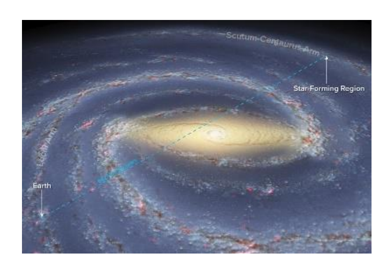
They are the greatest units that form the universe

Each galaxy has distinctive shape according to the harmony and order of the groups of stars on it

Galaxies *gather in groups called clusters* مجموعات



Galaxies clusters مجموعات المجرات they are groups of galaxies that rotate together in cosmic space by the effect of gravity



The Milky Way A lot of old stars gather in the center surrounded by small stars located in the spiral arms of the galaxy.

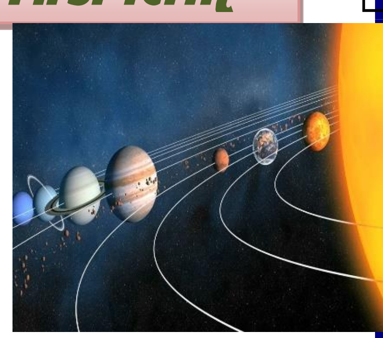
The Milky Way one of the spiral galaxies

The Milky Way contains the sun and the solar system

Our sun *is a star of millions of stars* rotate *around the* center of galaxy.

G.R. The Milky Way is given that name?

Because it appears in the sky at night as a splashing milk اللبن المرشوش *or spreading straw* القش المبعثر



The solar system

It is the sun and eight planets revolving around the sun

The solar system *is located* **in one of the spiral arms** *of the Milky Way on the* **edge of the galaxy**

The sun takes *about* *220 million years* *to complete one rotation around the centre of the galaxy.*



The earth the planet *Planets revolve around the sun*

Planets revolve around the centre of the galaxy (Milky Way).

Measuring distance between the celestial bodies

The distances in the universe are so vast so that they are measured by the light-years. Since the speed of light equals 300000 km / second

Light year It is the distance covered by light in one year

it equal = 9.467×10^{12}km (94670000 million kilometer)

What is the meant by

The distance between the sun and a star is 3 light years?

This means that the distance the sun and this star =$3\times9.467\times10^{12}$ km

= 28.401×10^{12} km

Activity

Expansion of the universe and distances of Galaxies

Tools: *worm water - some flour - some raisin* الزبيب



Activity

1- *Mix Flour with some water and some of the bread yeast to make bread dough. (Which represent the universe)*

2- *Mix the ingredients well to make bread dough*

3- *Insert some raisins (which represent the galaxies) in the dough.*

4- *Leave the dough to ferment in a warm environment.*

Observation *Represented* تباعد *by raisins - spacing of planets in the universe*

Conclusion *of the existence of spaces between the grains of raisin great void in the universe (expansion size of the universe)*

Information *In 1964, scientists* **Robert Wilson** *and* **Arno Pinzias** *coincidently* مصادفة *discovered radio waves coming from space. They concluded that these waves are a type of the echo coming from the Big Bang. T.V sets can receive such signal on the Earth.*

History of the universe

The stages of the origin of the universe since Big Bang



Through Big Bang

The gaseous ball form which the universe originated exploded and the process of expansion and changing



Within minutes

The temperature become about 10000 million degree
*The atomic particles produced from explosion merged together producing gaseous clouds of 75% **hydrogen** and 25% **helium**.*
These gases produce the galaxies, stars and universe through millions years

After 1000 million years

The previous formed matter merged in the form of masses

After 2000 to 3000 million years

*Gravity help in gathering more masses forming (**Ancestral galaxies**) having areas of empty space between them*

After 3000 million years

Galaxies *began to* **form**



After 5000 million years

Our Galaxy The Milky Way, took its disc form



After 10000 million years

The Sun was born
Then the earth and planets were created



After 12000 million years

Earliest life forms *began to appear on earth*





After 15000 million years

The **universe** *as it* **now**



Theories about the evolution of the solar system

1. *There are many scientific and philosophical theories about the evolution of the solar system. they are about twenty theories and they (as we shall see)*
2. *They are still unproved and subject to change.*

We will study the most important of these theories to recognize the evolution of scientific ideas about the evolution of the solar system.

1-Nebular assumption (Laplace)	The crossing star theory (Chamberlain and Molten)	3-The modern theory of the world (Fred Hoyle)



1-Nebular assumption (Laplace 1796)

1. *In 1796 Laplace published a research entitle (World order)*
This research included a vision of Laplace about the evolution of the solar system
2. *This perception has been affected by two observations. Which are*

a- There is something that looks like clouds or nebula in the space.
b-The space contains many cloudy rings surrounding some planets such (rings of Saturn.

It suggested that the solar system developed as the following:



1 — The contraction of nebula

A- *The Solar system originated from (glowing gaseous sphere). Called* **Nebula**

B- *it lost its heat gradually, so its size contracted and its revolving speed around itself increased.*

2 — The gaseous rings

a- under the effect of **centrifugal force** *the nebula lost its sphere form and became in a form of a* **flat rotating disk.**

b- Parts *got* **separated** *from it by the effect of the* **centrifugal force** *to form* **gaseous rings** *that also rotate in the same direction in which the nebula rotates.*

3 — the formation of solar system

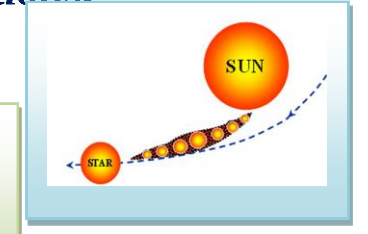
a-The **gaseous rings** *were cooled and frozen forming the* **planets** *of the solar system.*

b-The flaming mass that remained in the center formed the **sun**.

2-The crossing star theory (Chamberlain and Molten 1905)

The crossing star theory is based on some assumptions:

1. 1-A **huge star** *approached* to the *sun*.



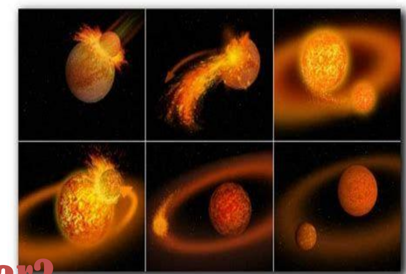


2. 2-This **star attracted** the *sun* to it, which led to a **great expansion** in the **part** of the **sun facing it**

3. 3-*This* **expanded part** was exploded which lead to
   - a *gaseous line was formed* of a great length from the sun
   - The *sun escaped from the gravity* of



4. - 4-The **gaseous line started** *to condense* due to the *attraction forces* and then it *cooled* **forming the planets**.



G.R. The sun escaped from the gravity of the star?

Due to the explosion of the expanded part of the Sun

3-The modern theory of the world (Fred Hoyle, 1944)

Sometimes seen when a **star glows** for a short time to be one of the *most shining stars* in the sky.

After a day or two, its glow **disappears gradually** to *return as it was*.

The reason for that glow is not known. It may be *due to the explosion* of *the star as a result* **of nuclear reactions** that occur so suddenly and violently

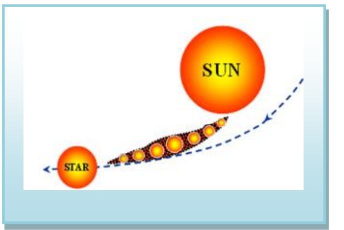
The star bombs *huge amounts of gaseous* materials.

Then, its size increases and accordingly its shining increases as well.

When the bombed gases are cooled, its shining returns as it was.

Fred Hoyle **used this fact to develop his conception and assumptions about the evolution of the solar system.**

He assumed :(modern theory of the world (Fred Hoyle)





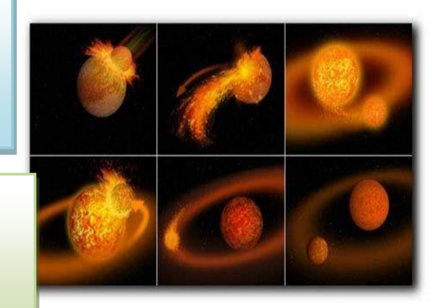
1- A star was rotating near the sun



2-The star exploded due to huge nuclear reactions.

3-The force of the explosion led to the bombing of the star's nucleus away from the gravity of the sun.

4-A cloud of gas remained and was subject to cooling and contraction processes forming planets.



5-The force of the sun's attraction controlled the orbits of planets around

The difference in the length of the day and year from a planet to another planet to another

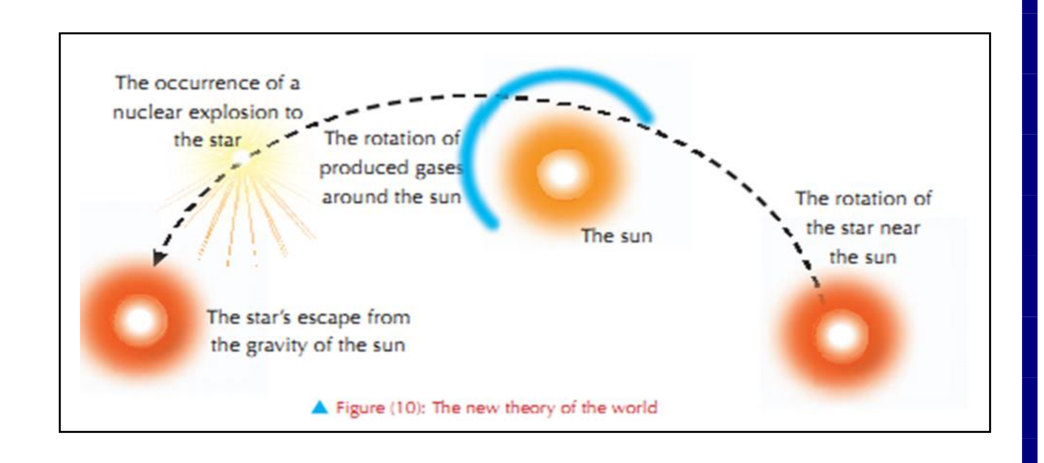


Figure (10): The new theory of the world

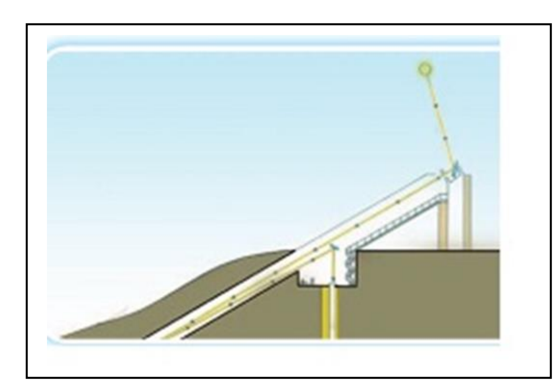
The solar telescope



The place *it is centered on the earth*

Used *it form a picture of a sun*

- *The solar telescope work on reflecting the sun rays downward to a mirror in a tunnel under the Earth's surface*
- *Sunlight is gathered then separated by the spectrometer into a solar spectrum (shows the different light wavy lengths emitted by the sun).*
- *Astronomers got most of their information about the sun from the study of its spectrums.*
- *A picture of the sun is formed in a monitoring room where astronomers can study its light.*



Telescopes rotating in orbits around the Earth are better than are bee on the surface aria of the Earth ?

Because they can see celestial bodies more clearly.

Also, they can catch rays able to penetrate the Earth's atmosphere.

The Hubble telescope



- *The Hubble telescope was launched in April in 1990*
- *It rotates around the earth at a height of 500 km.*

The importance of Hubble telescope

- *It collects photos for the universe since millions of years.*
- *These photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.*
- *Astronauts on a space shuttle regularly maintain this telescope in space.*

Unit Three Lesson one

1- Choose the correct answer:

1. The number of galaxies in the universe is about ……million galaxies
a.10 000 b . 100 000 c. 20 000 d . 200 000 .

2. The building units of the universe are ………..
a. planets b. stars c. galaxies d . moons

3. The universe contains a galaxies and stars .
a. Galaxies and stars b . planets and moons .
c . living organisms d . all the pervious answers .

4. Galaxies are formed of groups of .....
a. moons . b . constellations c. stars d . planets .

5. Galaxies gather in groups known as ... Ismailia 2014
a. galaxies clusters b . solar system .
c . ancestral galaxies d . planets

6 . ... are located in the spiral arms of Milky Way galaxy .
a. Old stars b . Moons c . Small stars d . (a) and (c)

7 . ... is the star of our solar system .
a . Moon b . Galaxy c . The Earth d . The Sun

8. The Sun and the surrounding planets revolve around the centre of the
a . Earth b . Moon . c . Galaxy d . no correct answer .

9. The solar system consists of the Sun and planets rotate around the Sun.
a. nine b . eight c . six d. seven

10. The solar system is located in one of the .... arms of the Milky Way galaxy .
a . spiral b . oval c. straight d . circular

11. The Sun takes about .... to complete one rotation around the centre of the galaxy .
a . 220 thousand years b . 220 million years
c . 230 million years d . 320 million years

12. The light year is ……….
a.. the distance covered with light in one year .
b . the light speed in km / sec .
c . the time consumed by light to cover a certain distance .
d . the speed of light and electromagnetic waves in km / sec .

13. Astronomers measure the distances between stars with light year , because the stars….
a. generate great amounts of light and heat b. seem small light points .
c . are millions of kilometers away from each other d . no correct answer

14. The scientists believe that the universe emerged from a massive explosion and it is in … a. continues contraction . b . contraction then expansion ,
c . expansion then contraction . d . continues expansion .

15. The continuous expansion of the universe is due to ... separation of galaxies . (Assiut 2019
a. separation of galaxies . b. approaching of galaxies .
c . equivalent of galaxies . d . no correct answer .

16. Scientists believe that the matter of the universe was a .... ball of high pressure and high temperature .

a. liquid b . solid c . gaseous d . no correct answer

17. After minutes from the Big Bang , the temperature becomes million degrees .

a. 100 b . 1000 c . 10000 d . 100000

18. .... are originated after about 2000 : 3000 million years of the Big Bang .

a . Galaxies b . Stars c . Planets d . Ancestral galaxies

19 …………….. began to form after 3000 million years of the Big Bang . Sohag 2019

a . Galaxies b . Stars c . Planets d . Ancestral galaxies

20. The two gases which produced galaxies , stars and universe over millions of years are (Cairo Kalyoubia 2020)

a . oxygen and helium . b . oxygen and carbon dioxide .

c . hydrogen and helium . d . hydrogen and carbon dioxide .

21. Within minutes after Big Bang , hydrogen gas was formed by a percentage of (Menia 2020

a . 25 % b . 50 % c . 75 % d . 100 %

22. Within minutes after Big Bang , helium gas was formed by a percentage of

a . 75 % b . 65 % c . 55 % d . 25 %

23. According to the Big Bang theory , within minutes from the origin of the universe , the ratio of hydrogen to helium is (Fayoum . Beni Suef 2020) .

a . 75 : 1 b . 25 : 1 c . 3 : 1 d . 1 : 3

24. The Milky Way galaxy took its disc form after about ...... million years from the Big Bang (Qena 2019)

a . 1000 b . 3000 c . 5000 d . 10000

25. The Sun was born after about million years from the Big Bang , (Luxor2018)

a 3000 b . 2000 c . 15000 d . 10000

25. The earliest life forms began to appear on the Earth after about million years from Big Bang

a. 15000 b. 13000 c.12000 d. 10000

27. Planets state around the Sun by the effect of the gravity of

a. the Sun b. Jupiter c. the Earth d . the moon

28. The biggest start that can be seen clearly by people on the Earth is

a. Saturn b . the Sum c. Uranus d. Neptune

29. The theory which explains how the universe originated is ……….theory

a. crossing star b. nebular c. solar nebular d. Big Bang

30. From the oldest theories which is explained the evolution of the solar system is

a. the crossing star b. the nebula c. the Big Bang d . Fred Hoyle

31. The scientist who established the nebular theory is

a. Newton b . Chamberlain. c. Laplace d . Moulton

32. According to Laplace assumptions , the nebula gradually lost its heat , so

a. its size contracted only b. its revolving speed and itself increased only .

c. it is vanished d. (a) & (b) are correct

33. Laplace theory assumed that the gaseous rings separate from nebula after its cooling and freezing forming the …….

a. Sun b. planets of the solar system c. gaseous ball d. universe

34 . Theory assumed that the solar system was originally a glowing gaseous sphere .

a. Nebular *b. Crossing star* *c. Modern* *d . No correct answer*

35. The scientist(s) who established the crossing star theory is are .....

a. Chamberlain and Moulton *b . Laplace*

c. Newton *d . Fred Hoyle .*

36…… theory assumed that the origin of the solar system was from the explosion of the expanded part of the Sun forming a gaseous line of a great length from the Sun due to a huge star approached to it .

a. Nebular *b . Big Bang* *c . Crossing star* *d . Modem*

37. The founder of modern theory to explain the origin of the solar system is….

a. Chamberlain *b. Moulton* *c . Fred Hoyle* *d . Laplace*

38. In the modern theory , bombing the star nucleus away was due to…..

a. the force of `gravity *b . collision by asteroids*

c. drop in temperature , *d . huge nuclear reactions*

39 : Fred Hoyle assumed that the Sun controls in the orbits of planets around it due to of the Sun

a. the temperature *b . rotational speed* *c. the attraction forced* *d. glowing*

40. Astronomers use special equipment to study the Sun , this equipment is the

a. glasses *.b . telescope* *c. lens .* *d . no correct answer*

41. The Hubble telescope was launched in April in ....

a. 1905 *b . 1990* *c. . 1995* *d . 1959*

2. Choose from column (B) , what suits those in column (A)

1

(A)	(B)
1. The Sun	a . is the space that contains galaxies
2. The galaxy	b . form galaxies
3. The solar system	c . is the greatest unit that form the universe
4. The universe	d . is the measuring unit of the distances between stars
5. The light year	e , contains the Sun and eight planets revolving around it
6. The Milky Way	f . is the galaxy that our solar system belongs to
7. Stars	g . is the star of our solar system

2

(A)	(B)
1. The crossing star theory	a . explains that the origin of the solar system is a glowing gaseous rotating sphere
2. The nebular theory	b . assumes that the origin of the solar system is a star rather than the Sun.
3. The modern theory	c . assumes that the origin of the solar system is the Sun
	d . thinks that the origin of the solar system is the Earth

3. Put (√) or (x) in front of the following sentences and correct the false ones :

1. The Earth is the space that contains all the galaxies , stars . planet , moons and living organisms ( )
2. Galaxies move away in the cosmic space . ( )
3. Galaxies rotate in a system around the centre of the universe . ( )
4. The universe contains various galaxies that move away from each other organisms ( )
5. Each group of stars is gathered in the solar system , ( )
6. The solar system is located at the edge or Milky Way galaxy ( )
7 . The solar system contain a lot or star ( )
8. Eight planets including the Earth rotate around the galaxy ( )
9. Nine planets rotate around the Sun ( )
10. The universe emerged from the particles of oxygen and nitrogen ( )
11. The universe is in a state of continuous expansion ( )
12. Galaxies emerged from the Big Bang . ( )
13. The matter of the universe was a gaseous ball of high pressure and high temperature ( )
14. Galaxies began to form after about 2000 million years from the Big Bang ( )
15. Our galaxy took its disc form after about 5000 million years from the Big Bang ( )
16. The crossing star is the largest star that can be seen from the surface of the Earth ( )
17. The gravity of the Earth keeps the rotation of planets in fixed orbits around the Sun ( )
18. An assumption of the crossing star theory is that a star revolves near the Sun ( )
19. Fred Hoyle who put the nebular theory about the evolution of the solar system( )
20. According to modem theory the star exploded due to huge nuclear reactions ( )
21. According to Laplace theory , the origin of the solar system was the Sun. ( )
22. Attraction force of the Sun that controls the orbits of planets around it , is one of Laplace's assumptions ( )

4. Correct the underlined words :

1. Each galaxy has a distinctive shape according to the harmony and order of the groups of planets in it (Cairo 2013)
2. The solar system lies in Andromeda galaxy
3. The galaxy is the distance covered with light in one year . (Share 2015)
4. The old stars gather in the edges of the galaxy
5. The solar system lies in one of the circular arms of the Milky Way galaxy .
6. The solar system contains many stars .
7. The crossing star is a big star can seen from the Earth .
8. The unit for measuring distances between galaxies is kilometer.

9. The Sun takes about ***100 million*** *years to complete one rotation around the center of the galaxy*
10. The Sun and the surrounding planets revolve around the center of the ***solar system.***
11. According to Big Bang theory the universe is formed by merging of oxygen and ***nitrogen*** *particles*
12. Many scientists believe that the universe emerged from a massive explosion called Big Bang since ***500 thousand years.***
13. The theory that explains the origin of the universe is the ***nebular theory***
14. The ***Big Bang*** *theory depends on there is something that looks like clouds or nebula in the spice.*
15. The ***crossing star*** *is a glowing gaseous sphere revolving around itself from which the solar system was originated.*
16. The scientist ***Isaac Newton*** *published a research entitled " World order "*
17. Nebular theory suggested that the solar system was originated from a glowing gaseous sphere revolving around ***the Sun.***
18. The Earth rotates in a fixed orbit due to the effect of the ***Earth's gravity.***
19. The Earth planet belongs to a galaxy called Hubble .
20. The founder (s) of crossing star theory ***is Laplace*** *.*
21. Sudden violent ***chemical*** *reactions occur within the star which led its explosion*
22. The scientist who established the modern theory about the origin of the solar system was the scientist ***Laplace****. .*

5.Write the scientific term of each of the following statements

1. • The space which contains all the galaxies , stars , planets , moons , living organisms and everything
• It is the wide and extended space that contains galaxies .
2. • The greatest units that form the universe .
• A large gathering groups of stars found in clusters .
• Groups of stars that rotate together in the space by the effect of gravity .
• Many groups of stars have distinctive shape and harmony .
3. The group of galaxies which revolves together in the universe space due to the gravity
4. • It contains all the stars we see at night in the sky .
• The galaxy that is our solar system belongs to .
• A galaxy appears in the sky at night as spreading straw or splashing milk .
• It contains the Sun and the solar system .
5. • It is located in one of the spiral arms of the Milky Way galaxy on the edge of the galaxy
• It contains the Sun and eight planets revolving around the Sun. .
6. • The unit that is used to measure the distances between the celestial bodies .
. • The distance that is covered with light in one year .

7. The continuous separation between galaxies in the universe due to their regular motion .
8. • The expansion of the universe and merging of atomic particles forming helium and hydrogen gases .
• A theory that explains the origin of the universe due to a great explosion , followed by continuous expansion and changing processes since 15000 million years .
9 . The biggest star that can be seen clearly by people on the Earth .
10. The force that controls in the orbits of planets around the Sun according to modern theory .
11. The scientist who established the nebular theory
12. The scientists who established the crossing star theory about the evolution of the solar , system
13. • A flat gaseous round disk that formed the solar system .
• A glowing gaseous sphere revolving around itself that formed the solar system
14. A theory assumed that the solar system was originally a glowing gascots sphere revolving around itself .
15.A theory assumed that the solar system was originally a big star (the Sun) .
16. • A theory assumed that the solar system was originally a star rather than the Sun • A theory assumed that the solar system was originally a star which was glowing for a short time and then its glowing disappears gradually
17. Glowing of a star for a short time to become one of the most shining stars in the sky , then its glowing disappears gradually to return as it was
18. Special equipment centered on the Earth or carried into space used to study the Sun.
19. An equipment was launched into the space, allowing astronomers an opportunity to study the evolution of the universe after the Big Bang. *(Alex 2011.Ghar 2019)*

6. Give reasons for the following:

1. Our galaxy is called the Milky Way galaxy
2. • The difference in the shapes of galaxies that form the universe.
• Each galaxy in the universe has a distinctive shape .
3. Astronomers don't measure the distances between stars in kilometers.
• The distances in the universe are measured in light year.
4. The continuous expansion of the space (universe) .
5 . Galaxies move away from each other
6. The stability of the Earth rotation in an orbit around the Sun .
7. The constancy of the planets in their orbit around the Sun
8. • The nebula lost its sphere form and became in form of a flat eating dick
• Separation of parts of nebula and formation of gaseous rings rotate in the same direction in which the nebula routes
9. Explosion of some stars suddenly
10. The Sun escaped from the gravity of the huge star in the crossing star theory

7. What are the results based on ...

1. • Galaxies move away from each other as time passes
• Separation distances of galaxies .
2. Groups of stars are gathered in the universe
3.The merge of the atomic particles together within minutes of the Big Bang
4. Occurrence of Big Bang
5. The nebula lost its temperature in Laplace's opinion .
6.The expanded gratis between the sun and the crossing star explodes de cording Chamberlain and Moon
7.The explosion of the star nearer to the Sun according to Fred Hoyle. "
8. Approaching of a huge star to the Sun according to the crossing star theory,
9. The gaseous cloud is cooled in Fred Hoyle theory)

8.What happens... ?

1. • If the gravity between the Sun and planets which rotate around is vanished.
• When there is no gravity in the solar system.
• When the force of the Sun gravity doesn't control the orbits of planets around
2. When the distance between a planet and the Sun increases.
3. If the organization and arrangements of the groups of stars in galaxy were changed Gravity in solar system. (Matrouh 2019

9.Mention the importance of each of the following .

1. Gravity in solar system. (Matrouh 2019)
2.Light year,
3. The gaseous line in the crossing star theory. (Sharkia 2015)
4. Solar telescope
5. Hubble telescope

Unit (4) Reproduction and Species Continuity

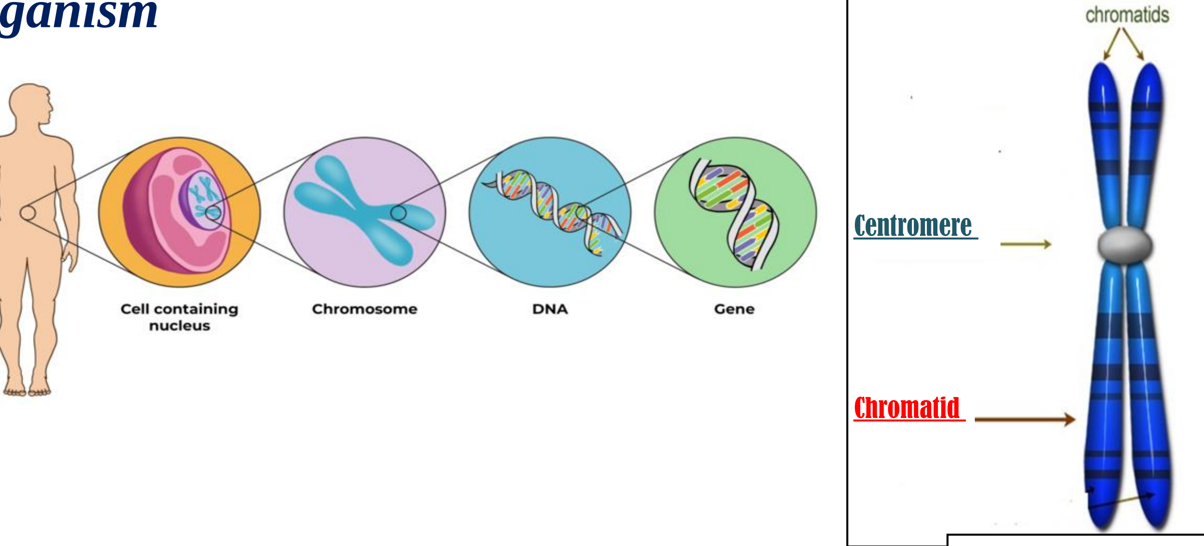
Chapter (1) Cell Division

Multicellular organism's bodies contain two types of cells:

1-Somatic cells	2-Reproductive cells
are divided by **mitosis**	are divided by **meiosis**
• *Leads to the growth* of living organisms • *Compensation* of the damaged cells.	• *leads to the formation of male and female gametes* • *transfer of genetic traits* from parents to their offspring
• Ex:- cell of lever . skin-Kidney *in animals* • Cells of leaves –stems *in plants*	• Ex:- *cell of* anther . ovary *in flowering plants* • Cells of sperms –ova *in humans and animals*

Nucleus is responsible for cell division

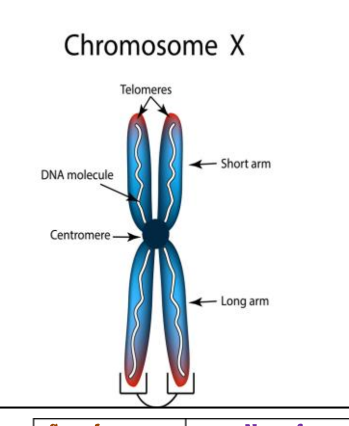
- *The cell nucleus* contains the *genetic material* of the living *chromosomes*
- **Chromosomes** they are thread like bodies present in cells nuclei and they represent to genetic material the living organism



chromosome

Structure of chromosome:

1- The chromosome consists of
A- **Two** threads called a **chromatid**
B- **Connected** at the **centromere point**
2-The chromosome **chemically** consists of nuclear acid called **DNA** and **protein**.
DNA carries the **genetic traits** of the organism.



Species	No. of chromosomes
Dog	78 (39 pairs)
Onion	16 (8 pairs)
Peas	14 (7 pairs)
Potato	48 (24 pairs)
Human	46 (23 pairs)
Wheat	42 (21 pairs)
Mosquito	6 (3 pairs)

Information about chromosomes

1-The number of chromosomes in living organism is different from species to another
2- The number of chromosomes fixed in the same species.

1-Somatic cells	2-Gametes (Male – Female)
contain complete two sets of chromosomes (2N) (one inherited from the father and the other inherited from the mother)	Each of them contains a half number of chromosomes present in somatic cell **The gametes** (male gametes (sperm) female gametes(N) (ovum)
Known as the diploid number (2N),	Known as the haploid number(N).

Importance of chromosomes

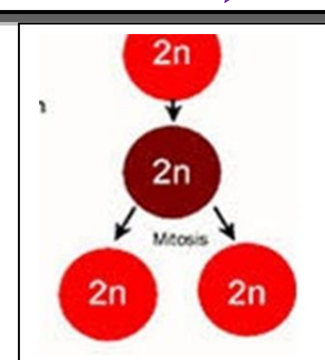
1-Knowing the number of chromosomes helps in identifying the animal and plant species
2- They have the main role in cell division

Cell division

There are two types of Cell division Mitosis and Meiosis

Mitosis (Mitotic cell division)	**Meiosis** (Meiotic cell division)
(Direct cell division)	(Reduction cell division)

First: Mitosis division



Mitosis division It is a kind of cell division that occurs in the somatic cells, at which the cell divides into two new cells contain the same number (diploid number)

Site of occurrence (site) in the somatic cells (All body cells except reproductive cells and neural cells(no centrosome) and red blood cells (no nucleus)

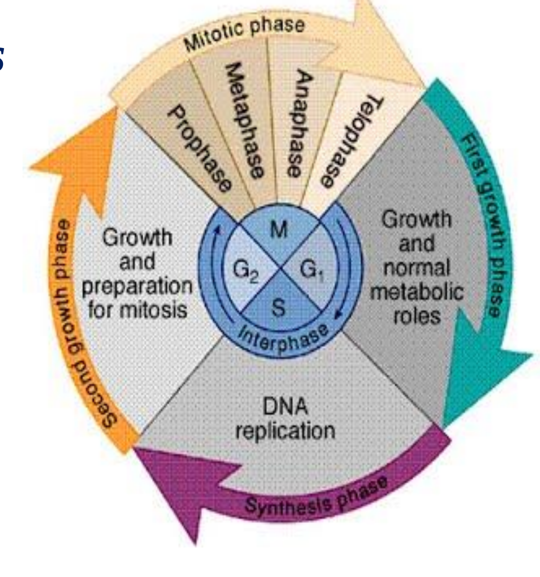
(Ex:- in animals cell of lever, skin and Kidney
in plants Cells of leaves –stems)

Important of Mitosis it play an important role in

1-Growth of the living organisms (growth of seeds to complete plant)

2-Compensation of the damaged cells.

3-Complete the **asexual** reproduction process

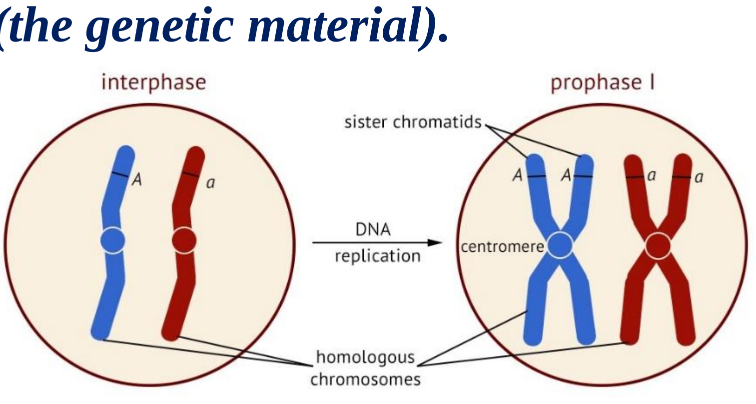


Interphase

It is a phase occur before starting Mitosis division to prepare the cell for division and Duplicating the amount of DNA

Importance of the interphase

1- To prepare the cell for division.
2- Duplicating the amount of DNA (the genetic material).



Before cell division chromosome appear as chromatid then duplicate during *interphase*

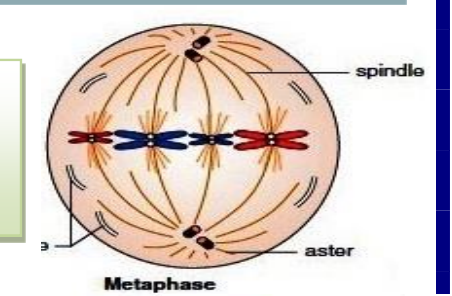
The cell enters into the mitosis which takes place through the following phases:

1 Prophase

1-Chromatin reticulum condenses and appears in form long and double strings (chromosomes).

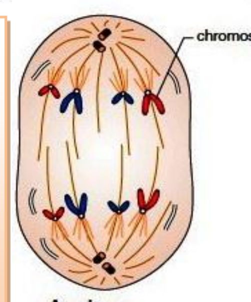
2- Spindle fibers is formed extending between the two poles of the cell

- in the animal cell The spindle fibers is formed from the centrosome
-In the plant cell, the spindle is composed from intensifying the cytoplasm at the cell poles.



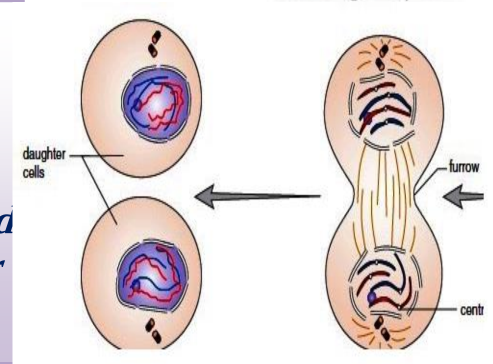
2 Metaphase

The chromosomes which is connected with one of the spindle fibers are arranged along the cell equator



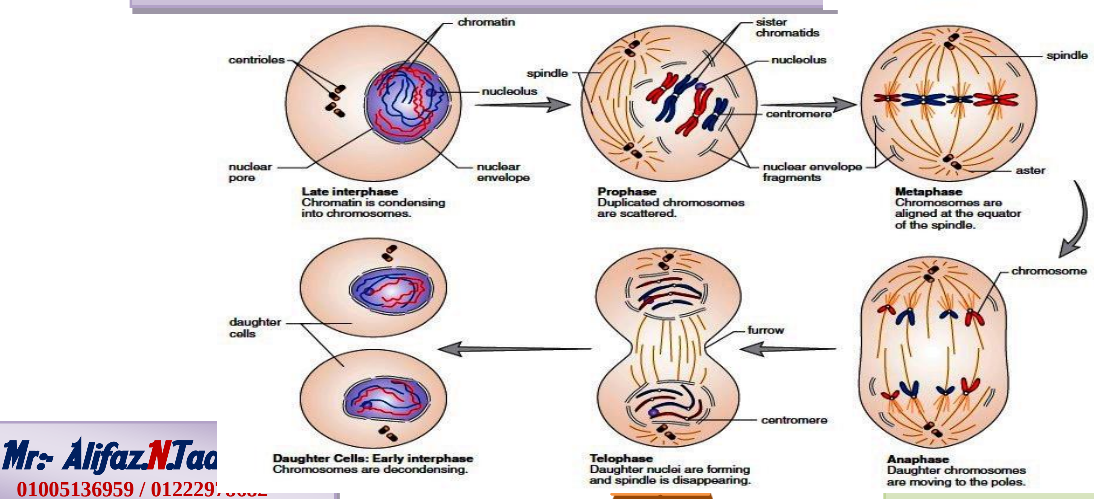
3 Anaphase

1-Centromere of each chromosome splits lengthwise into two halves.
So Chromatids separate from each other
2-Spindle fibers begin to shrink and two - identical groups of chromatids are formed.
Each group migrates towards one of the cell's poles.



4 Telophase

1-The spindle fibers disappears
2- The nuclear membrane is formed
3- Formation two nuclei at the two poles
4- At the end of this phase the cell divided into two new cells have the same number of the mother cell's chromosomes (2n).



Technological application
Liver Transplantation

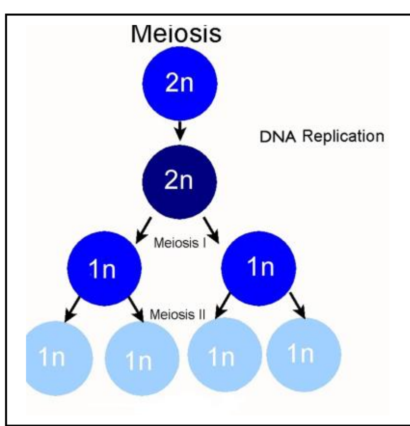


Some cells in the human body are **not divided** at all such as **nerve cells** and **red blood cells.**

Some cells are **not divided in normal** conditions but they retain the ability to **divide** under certain **circumstances** such as **liver cells.**

For example, if the liver gets injured or a part of it is cut, the remaining cells undergo mitotic division so as to compensate the missing part.

Second: Meiosis division



Mitosis division It is a kind of cell division that occurs in the reproductive cells, at which the cell divides into four new cells contain the half number (diploid number)

Site of occurrence reproductive cells.

1-In humans and animals in the **testis** (to produce male gametes **(sperms)** and in the **ovary** to form the female gametes **(ova).**

2- in flowering plants in the anther to produce the male gametes **pollen grains** and in the flower ovary to form female gametes an **egg**.

Important of Meiosis

1-Produced male and female gametes (cell contains half the number of chromosomes of the parent cell).

2- Complete the sexual reproduction

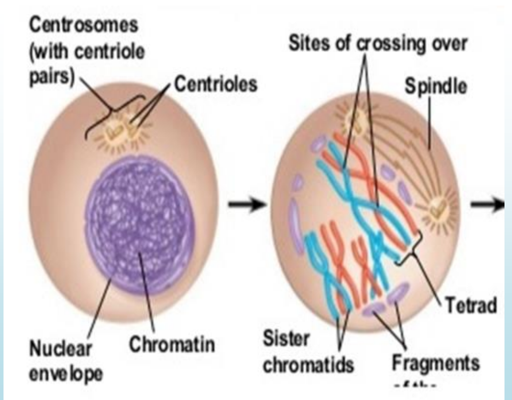
interphase **Before starting Meiosis division** the cell passes through a phase called

It is a phase occur before starting Meiosis division to prepare the cell for division and Duplicating the amount of DNA

This reduction occurs by the meiosis in two stages

(-First meiotic -Second meiotic division)

First meiotic division



1 Prophase I

1-Chromatin reticulum (intensifies)and appears in form of distinct chromosomes.

2- At the end of the prophase The nucleolus and nuclear membrane disappear.

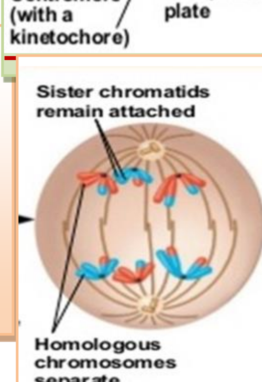
3-the chromosomes are arranged in homologous pairs each pair consists of 4 chromatids are called a tetrad

4- Every two homologous chromosomes (in the tetrad) start to move away from each other.

5-The spindle appears and the chromosomes get connected with spindle fiber.



2 Metaphase I



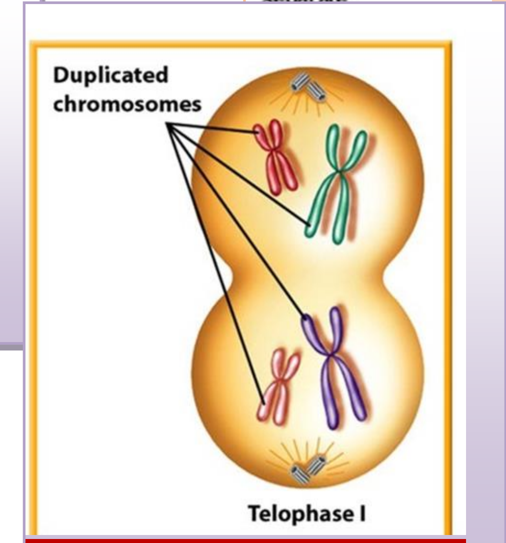
Chromosomes pairs arrange on the cell's equator.

3 Anaphase I

1- The spindle fibers shrink. So every two homologous chromosomes start to move away from each other.
2-One of the two chromosomes migrates towards a cell pole and the other migrates towards the other pole
3-Each pole contains half the number of chromosomes of the parent cell.

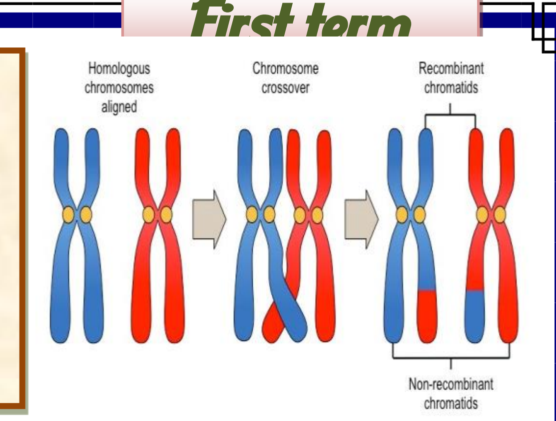
4 Telophase I

1-The spindle fibres disappears
2- the nuclear membrane is formed
Each nucleus has half the original number of chromosomes of the parent cell.
Then the cell enters into the second meiotic division.



The crossing over phenomenon

It take place at the end of **prophase I,** in which some parts of the two **inner chromatids** of each tetrad are **exchanged** to produce new genetic arrangements.



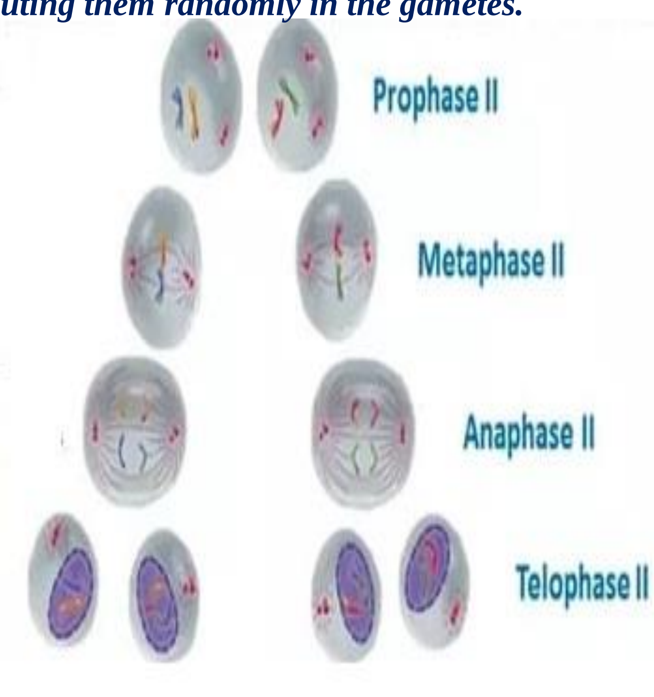
Tetrad It The chromosomes are shown in homozygous pairs, **each pair consists of 4 chromatids** in which **some parts of the two inner chromatids of each tetrad are exchanged** to produce new genetic arrangements..

The importance of the crossing over phenomenon

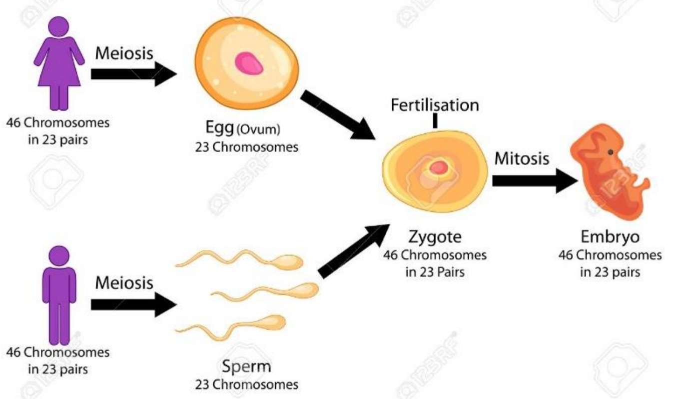
1- The variation of genetic traits *among the members of the same species.*

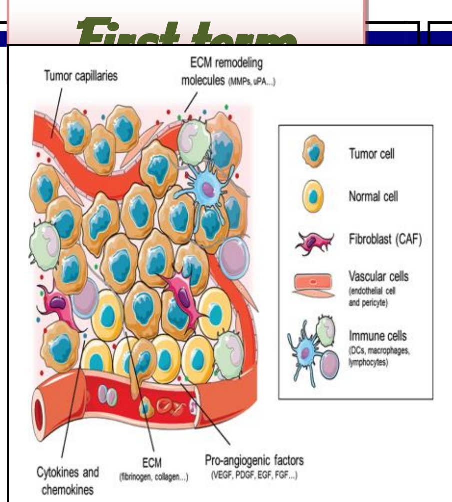
2- It contributes in exchange of genes *(that carry genetic traits) between the two homologous chromosome's chromatids and distributing them randomly in the gametes.*

Second meiotic division:



It aims to increase the number of produced cells.
Each cell is called the (gamete), containing half the number of species chromosomes.
Each cell of the two cells which resulted from the first meiotic division is divided in a way similar to mitosis division phases.
In the final phase (telophase II) of this division, four cells are produced and each of them contains half the number of chromosomes of the parent cell.
When the male gamete combines with the female gamete, the zygote is formed. It contains the original number of the organism's chromosomes.
Thus, the number of chromosomes remains constant in the cells of members of the same species.





Science, Technology and Society

Nanotechnology and cancer treatment

Cancer - It occurs when the body cells are divided continually without controlling. To from mass is called the **tumor**.

Tumor The of mass cells produced from abnormal continuous division

The Egyptian scientist Dr. Mustafa El Said



Discovered a way to detect the cancer cells and kill them by using very small molecules of Gold measuring by nanometer (NANO- molecules.) and technic called (NANO- technology)

Discovering cancer disease *This technical starts by loading proteins (they have the ability to attach to the cancerous cell secretions) with NANO- molecules of gold and then injecting them into the patient. The infected cell surface proteins get intertwined with the golden molecules to make it possible to monitor the infected cells through a microscope; each cell separately.*

Treatment cancer

1- Focusing laser with a certain degree to the gold molecules.

2- It absorbs the light and converts it into heat which leads to burn and kill the infected cell.

Using nanotechnology, *scientists have developed* **smart microscopic bombs** *that* **penetrate the cancer cells** *and explode them from the inside.*

They were **used to kill the cancer cells in experimental mice**. *Mice suffered from cancer were able to* **live 300 days** *after this treatment. As for mice that did not receive treatment, they* **did not live more than 43 days.**

The phase	Mitosis	Meiosis
It's importa[nce]	1-Growth of the living organisms 2-Compensation of the damaged cells. 3- Complete the Asexual reproductive	1-Produced male and female gametes 2-complete the sexual reproduction
interphase	prepare the cell for division cell passes through interphase phase The amount of DNA duplicates	prepare the cell for division cell passes through interphase phase The amount of DNA duplicates
1-Prophase	1- chromosomes appear 2- Spindle fibers appear between the two poles of the cell. 3-the nucleolus disappear 4-nuclear membrane disappear.	1- chromosomes appear 2- Spindle fibers appear between the two poles of the cell. 3-the nucleolus disappear 4-nuclear membrane disappear 5-the chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids are called a tetrad 6- crossing over phenomenon occur
Metaph[as]e	The chromosomes arranged along the cell equator	Chromosomes pairs arrange on the cell's equator
3-Anaphase	1-Centromere splits into two halves. 2-Spindle fibers shrink and two - identical groups of	1- Centromere don't splits 2- spindle fibers shrink. chromosomes start to move away from each other. 3-Each pole contains half the number of chromosomes of the parent cell.
4-Telophase	1- chromosomes disappear 2- Spindle fibers disappear 3-the nucleolus appear 4-nuclear membrane dappear.	1- chromosomes disappear 2- Spindle fibers disappear 3-the nucleolus appear 4-nuclear membrane dappear.
Resulti[ng] cells	Two cells are produced(2n)have the same number of parent chromosome	Four cells are produced(n) have the half number of parent chromosome

Unit four Lesson one

1- Choose the correct answer:

1. The chemical structure of the chromosome is…….
a. the nucleic acid only c. protein, and nucleic acid
c. protein, fats and nucleic acid d. all the previous

2. Chromosome is chemically consists of nucleic acid …….and protein
a. HNO_3 b. H_2SO_4 HCL d. DNA

3.The somatic cells in most of living organisms contain two groups of chromosomes called …..
a. diploid number. b. haploid number. c. spindle fibers d. tetrad

4. The gametes contain a group of chromosomes called ……….
a. diploid number. b. haploid number. c. spindle fibers d. tetrad

5. The type of division in somatic cells is…………….. division
a. meiotic b reduction c. mitotic d. no correct answer

6. Mitotic division happens in cells of the
a. two testes b two ovaries. c. Liver d. (a) and (b) together

7. ………cells are not divided at all.
a. Skin b. adult red blood c. Liver d. Stomach

8. The …… is the phase in which the cell is prepared for division by doubling genetic material.
a. prophase b. Interphase c. metaphase d. telophase

9. Which of the following is not considered from phases of cellular division?
a Prophase. b. Interphase c. metaphase d. Anaphase

10. The genetic material (chromatin reticulum) condenses and appears in the form of long thin and double strings in……….
a. prophase b. Metaphase. c. Anaphase. d. telophase

11. In the mitotic division, the chromosomes are arranged at the equator of the cell during ….
a. metaphase. b. prophase c. anaphase. d, telophase..

12. Chromosomes are arranged in homologous pairs to form tetrad in . (South Sinai
a .metaphase I. b. telophase I c. anaphase I. d. prophase I ,

13. The centromere of each chromosome is divided longitudinally, then the two chromatids are separated from each other and the spindle fibers contract in mitosis during
a. prophase. b. telophase. c. anaphase. d. metaphase.

14. Spindle fibers appear during the cell division in the.
a. prophase. b. metaphase. c. anaphase. d, telophase.

15. Spindle fibers in the animal cell are formed from the
a. centrosome. b. cytoplasm c. nucleolus d. Chromosomes

16. Spindle fibers disappear during cell division in the.
. a. prophase. b. metaphase. c. anaphase. d, telophase.

17.The nucleolus disappears during the mitosis cell division in
. a. prophase. b. metaphase. c. anaphase. d, telophase.

18. The right arrangement of the phases of mitosis is
a. prophase, metaphase, anaphase and telophase
b. prophase, anaphase, metaphase and telophase.

c. anaphase, prophase, metaphase and telophase.
d. metaphase, prophase, anaphase and telophase

19. Meiotic division happens in the cells of the ....
a. liver b. testes c. skin. d. bones.

20. The ratio between the number of chromosomes present in the gametes produced by meiotic cell division to the number of chromosomes present in somatic cells is...
a. quarter. b. double. c. third. d half

21. Meiosis is different from meiotic in that each produced cell contains .... of the parent cell
a. quarter. b. double. c. third. d half

22. Meiotic cell division is responsible for the
a. growth of organisms b. compensation of damaged cells
c. production of gametes d. duplication of cells number

23. Meiotic division occurs in flowering plants in the anther to produce
a. ovum b. pollen grains. c. sperms. d. chromosomes.

24 Chromatin reticulum intensifies and appears in form of distinct chromosomes in phase ....from meiosis division
a. prophase 1 b .metaphase I. c. anaphase I. d. telophase I ,

25. crossing over phenomenon happens in the end of the a first prophase second
a. first prophase. b. first anaphase. c. second metaphase. d. second anaphase

26. A tetrad consists of ....chromosomes
a. 2 b. 4 c. 6 d. 8

27. First meiotic division differs from the second meiotic division in ....
b. formation of the tetrad a. formation of the spindle fibers
c formation of the nuclear membrane d. no correct answer

28. Which of the following represents meiotic division?

a. 2N ↗ N, ↘ N b. N+N 2N c. 2N ↗ 2N, ↘ 2N d. 2N ↗ N ↗ N, ↘ N ↘ N

29. If the chromosomal number in the somatic cell is 2N, then its number in ....the reproductive cell is.
a. ½N. b. 4N c. 2N d. N

30. Number of chromosomes in female gamete equals .... the number of chromosomes in the original cell.
a. quarter b, half c. the same d. double 1.

31. The number of the chromosomes in the human liver cell is 23 pairs, which of the following contains a haploid number ?
a. Skin cell. b. Pancreatic cell. c. Fertilized ovum. d. Sperm

32. If the nucleus of a maize pollen grains contains 10 chromosomes, then the nucleus of somatic cell of the same plant contains ...... chromosomes.
a, 5 b. 10 c. 15 d. 20

33. The number of chromosomes in pollen grain is .... the number of chromosomes in ovum.
a. double b. half c. equal to d. quarter

34, If the number of chromosomes in liver cells of a certain living organism is 32 chromosomes then the number of chromosomes in a reproductive cell is .... chromosomes.

a 16 b. 64 c. 23 d. 16 pairs

35. If the cell of muscles in a female rabbit contains 22 pairs of chromosomes, so the number of chromosomes in one cell of its ovary equal

a. 11 b. 22 c. 44 d. 88

36. If the chromosomal number in the male gamete of an organism is 20 so, the chromosomal number in the liver cell equals chromosomes.

a.5 b. 10 c. 20 d. 40

37, The number of chromosome in each somatic cell and the sperm of a living organism…………… respectively

a.6,12 b. 5,6 c. 8,8. d. 12,6

38. The variation of genetic traits resulted from meiosis is due to the. ………..

a reduction of chromosomal number. b. crossing over phenomenon
c. duplication of DNA d. formation of tetrads

39. The cancerous cells can be detected by using of technological Nano-molecules of ……………metal.

a. zinc b. iron c. nickel d. gold

2. Choose from column (B) , what suits those in column (A) .

1

(A)	(B)
1.The spindle fibers shrink and two identical groups of chromosomes are formed at each pole of the cell in	a. telophase
2. Duplication of genetic material occurs in	b. prophase
3.The nucleolus and nuclear membrane disappear in	c. interphase
4.The chromosomes are arranged along the cell equator in	d. metaphase
	e. anaphase

2

(A)	(B)
1. Telophase	a. occurs in reproductive cells
2 Mitotic cell division	b. in which the chromosomes pairs arrange at the equator of the cell
3. Meiotic cell division	c. occurs in somatic cells
4 Metaphase	d. the nuclear membrane appears in it

3

(A)	(B)
I Reproductive cells	a. in which mitotic division occurs
2. Plant cells	b. produce gametes
Somatic cells	c. in which the spindle fibers is formed from the cytoplasm
	d, contains a haploid number of chromosomes

3. Put (√) or (x) in front of the following statements and correct the false ones:

1. The chromosomes are found inside the cytoplasm of the cell. ( )
2. Chromosomes are rounded bodies ( )
3. The chromosome consists of two chromatids connected at the cytoplasm. ( )
4. The genetic material in the nucleus consists of a number of chromosomes ( )
5. The chromosome chemically composed of RNA and protein. ( )
6. The number of chromosomes in somatic cells is haploid. ( )
7. The number of chromosomes in plant stem equal quarter its number in the pollen grains for the same plant. ( )
8. The gametes contain the diploid number of chromosomes. ( )
9. Gamete is the point of connection of the two chromatids of chromosome. ( )
10. Somatic cells are divided by meiosis which leads to the growth of living organisms and compensation of the damaged cells.
11. The genetic material in the cell duplicates in interphase. ( ).
12. The cell is prepared to enter the phases of mitosis division in the anaphase. ( )
13. Chromatin reticulum condenses and appears in the form of long, thin and double strings (chromosomes) in the telophase of the mitotic division. ( ).
14. The spindle fibers are formed in the plant cell from the centrosome. ( ).
15. The nucleolus disappears during the mitotic cell division in telophase. ( )
16. In the mitotic division, the spindle fibers are formed during the interphase and disappear ( )
17. In the animal cell, the spindle fibers are formed from condensing the cytoplasm at the cell pole ( )
18. In anaphase, chromosomes arranged at the middle of the cell. (Anist Z in the anaphase ( )
19. Chromosomes are arranged along the cell equator where each chromosome is attached with one of the spindle fibers at its centromere in anaphase ( )
20. The centromere of each chromosome divides longitudinally and the two chromatids separate in telophase. ( )
21. The ratio of number of cells produced due to the 3rd division to number of cells produced due to the 2nd division of a somatic cell equal ( )
22. Meiotic division happens in somatic cells. ( ).
23. Meiosis results in the formation of two cells, each contains half the genetic material of the parental cell. ( )
24. Gametes in living organisms are produced by special cells known as the somatic cells during the meiotic division. ( )
25. Reproductive cells are divided by mitosis which leads to the formation of gametes. ( )
26. Meiotic cell division aims to the production of the gametes. ( )
27. The meiotic cell division leads to the growth of living organisms. ( )

28. First meiotic division aims to reduce the chromosomal number to half. ( )
29. At the end of telophase I, two cells are formed, each contains half the number of chromosome of the parental cell. ( )
30. In the final phase of meiosis, the number of produced cells equals to quarter of the number of that are produced by mitosis. ( )
31. Crossing over phenomenon occurs in the anaphase of first meiosis ( )

4. A write the scientific term of each of the following

1.They are thread like bodies that have the main role in cell division
2. The part in the cell which is responsible for cellular division .
3. •It consists of two chromatids connected together at centromere .
4. The point of connection of two chromatids together of the chromosome during the cell division.
5. The nucleic acid that carries the genetic traits of the multicellular living organisms
6. A process through which the living cell divides into two cells or more to aim the growth or reproduction.
7. •A cell division that occurs in the somatic cells and results in the growth of me is a the living organism.
8. A phase in which some important vital processes occur to prepare the cell for division and the genetic material in the cell is doubled.
9. The phase of mitotic division in which the nucleolus disappears.
10. The part which is responsible for pulling the chromosomes towards the two poles of the cell during anaphase of cell division.
11. Fibers extend between the two poles of the cell in prophase.
12. A phase in which the chromosomes migrate towards the cell equator where each chromosome is connected with one of the spindle fibers at the centromere.
13. The phase in which some processes (a series of adverse changes) occur which lead to the formation of a complete set of chromosomes that equal in numbers with the mother cell's chromosomes.
14. • Cellular division which leads to the formation of gametes.
15. Specialized cells which produce gametes
16. • The cells resulting from meiotic division and have half number of chromosomes (N) of the original cell..
• Are produced from cells known as reproductive cell inside living organisms.
17. They are an arrangement of homologous pairs of chromosomes where each pair consists of 4 chromatids.
18. • It occurs at the end of the first prophase of the meiosis, in which some parts of the two inner chromatids are exchanged
19. A dangerous disease occurs when the body cells are divided continuously without controlling.
20. A mass of cells that produced due to the abnormal continuous division of cells

5. Give a reason for each of the following sentences:

1. Chromosome is considered as the genetic material for the cell.
2. Cellular division begins with interphase.
3. Duplicating the genetic material in interphase for cell division.
4. Somatic cell differs from reproductive cell.
5. The difference in the way of formation of spindle fibers in plant cell than in animal cell.
6. Shrinking of spindle fibers during the anaphase of mitosis division.
7. The changes that occur in telophase of mitotic division are called adverse changes.
8. The damaged nerve cells can't be compensated.
9. A donor for a part of the liver suffers no harm and can survive.
10. Meiotic division is called by reduction division.
11. The gametes are often (N), while somatic cells are often (2N).
12. Meiosis is considered as the source of genetic variation on which the variation of living organisms depending on
• The importance of occurrence the crossing over phenomenon.
14. Mitotic division is important for children than meiosis.
15. Existence of the centrosome in the animal cells.
16. Nano-technology is called by this name.
17. Laser is used for treatment of cancer by Nano-technology.
18. The technic of discovering the cancer cells by using the Nano-molecules of gold depends on using a special protein.

6. What is meant by .. ?

1. Chromosomes *2. The DNA.*
3. Centromere *4. Cell division,*
5. Spindle fibers during cell division. (Kalyoubia 2019)
6. Mitosis. *7. Somatic cells.*
8. The interphase. (Luxor 2016/ Red Sea 2018) *9. Meiosis.*
10. Meiosis division is a reduction division.
11. Crossing over phenomenon. *12. Tetrad*

7. Mention the importance of each of the following:

1. Chromosomes.
2. Centromere.
3. • Nucleic acid (DNA).
• Nucleic acid in the chromosome structure.
4. Mitosis in the somatic cells of organisms.
5. Spindle fibers.
6. Centrosome in the animal cell.
7. Meiosis division of reproductive cells.
8. Anther in the flowering plants.

9. Crossing over phenomenon.
10. Nano-molecules of gold.
11. Proteins that are loaded on gold molecules.
12. Laser in treating cancer by Nano-technology

8.What happens if... ?

1. The nucleus of the cell is removed.
2. The interphase before cell division does not occur,
3. The centrosomes disappear from the animal cell.
4 The parts of the inner chromatids are exchanged in the first prophase.
5. Reproductive cells don't divide by meiosis.
6. Crossing over phenomenon doesn't occur.
7. A liver gets injured or cutting a part of it.
8. Donated a part of your liver to a sick person.
9. Focusing laser on golden Nano-particles in the cells infected by cancer.

9. What are the results of ... ?

1. Somatic cells divide mitotically in the human body.
2. Each two homologous chromosomes come close to each other to form tetrad.
3. The parts of the inner chromatids are exchanged in the first prophase. (
4. • Meiotic division of reproductive cells occurs in human body.
• Reproductive cells are divided by meiosis.
5. The meiosis division inside the anther and the ovary of a flower.
6. Crossing over occurs at the end of prophase in meiotic division

Sexual and Asexual Reproduction

Living organisms are characterized by *Their ability to reproduce.*

Reproduction process It is a biological process where the living organism produces new individuals of the same kind and thus, ensuring its continuity. the genetic traits move from parents to offspring.

Types of reproduction in living organisms:

1 Asexual reproduction:	2 Sexual reproduction
It Occurs by **only one living** *organism.*	*It occurs through* **two living** *organisms, one of them is a* ***male*** *and the other is a* ***female***
It mostly occurs in single-celled living organisms **Such as** *budding binary fission*	*It occurs in higher living organisms of plants and animals.*
Take place by mitosis division	*Take place by meiosis division*
The genetic traits *move from parents to offspring*	**The genetic traits** *of offspring resulting combines the two sources*

First: Asexual reproduction:

Asexual reproduction It is a process where the living organism produces new individuals with genetic traits indicate to those of their parent

Occurs in

1. *Unicellular (single-celled) living organisms (As Yeast- bacteria)*
2. *Some multicellular (9HYDRA- Star-fish)*
3. *Plants and animals where a living organism produces new individuals that have genetic traits identical to the parents.*

Asexual reproduction includes mitosis *that does not require special systems or structures in the living organism.*
Because it take place by mitosis

Types of asexual reproduction

1- Binary fission
2 -Budding
3 - Regeneration
4 -Spore propagation
5 -Vegetative propagation

1- Binary fission

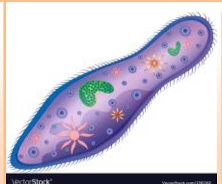
Binary fission It Is a type of asexual reproduction where the nucleus is divided by mitosis and then the cell splits into two identical cells

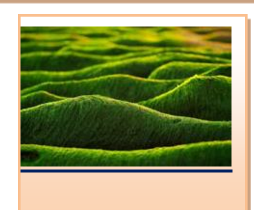
It occurs in

1-Unicellular protozoans *such as (amoeba -paramecium – euglena)*



2- Simple algae and bacteria.




How does the reproduction by binary fission occur?

1-The nucleus is divided by mitosis and then the cell splits into two cells
2- Each one becomes a new individual.

G.R. the cells that are result by binary fission are similar to the parental cells?

Because they are resulted by asexual reproduction (mitotic division)

G.R. the parental cells that are reproduces by binary fission dissapear?

Because it split into two identical cells

Prokaryotic chromosome
Plasma membrane
Cell wall
1 Duplication of chromosome and separation of copies
2 Continued elongation of the cell and movement of copies
3 Division into two daughter cells
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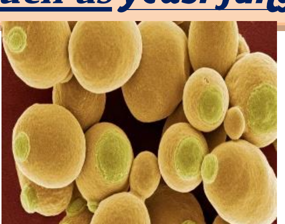
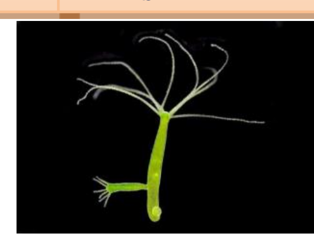
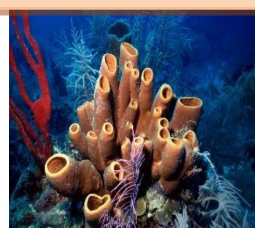
2 -Budding

Budding It Is a type of asexual reproduction that produces new individuals by formation of buds in the parents' cell

It occurs in

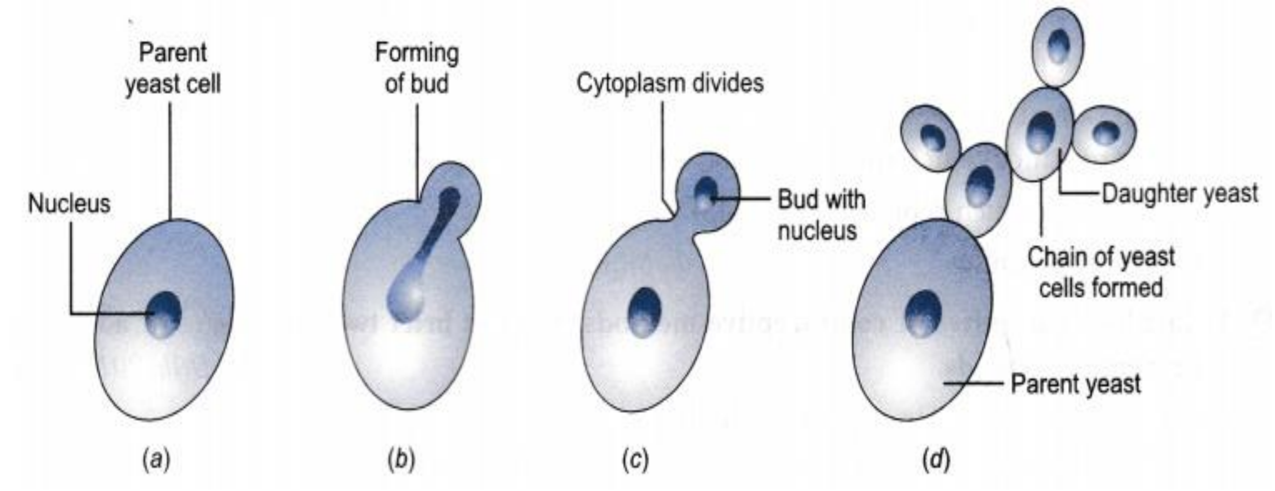
1-Unicellular living organisms *(such as yeast fungus)*

2-Multi-cellular organisms *(such as hydra and sponges)*

Activity

How does reproduction by Budding occur in yeast fungus.



Materials and tools : *Piece of yeast - sugar solution- warm water - microscope - a glass slide -cover slips – a teeth stick).*

Procedures:

1- Add the 1 ml sugar solution and 1 ml of warm water to 2 ml yeast in a plate and leave them for ten minutes in a warm dark place.

2- Take some of the mixture and place it on a glass slide. Place the cover slip gently.

3-examine the slide under the microscope

Observation

1-Bud in yeast emerges as a lateral bulge in the cell then

2- The cell nucleus is divided (mitosis) into two nuclei. One of them remains in the parental cell and the other immigrates to the bud.

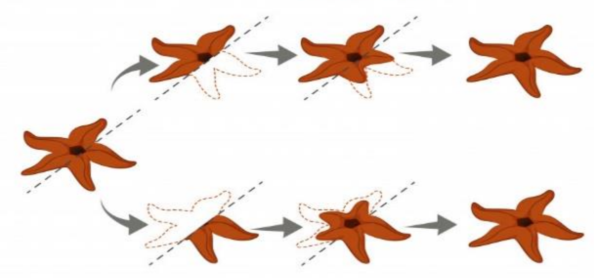
3-A bud grows gradually and remains connected to the parental cell until it is fully grown then separates from it or remains to form a colony

3 -Regeneration

Regeneration is the ability of animals to compensate their missing parts.

The living organism can reproduce by one of its parts.

Starfish arms *could be revived and give out a complete animal if they contain a part of the central disc of the animal.*



If the star fish missed on arm

The remaining part form new arm instead the missing arm

If the star fish missed all the arms

The part of center disc form a new animal



Question for thinking

If the number of chromosomes in a starfish mother cell is (2N), how many chromosomes are there in the cells resulted by regeneration? Why?

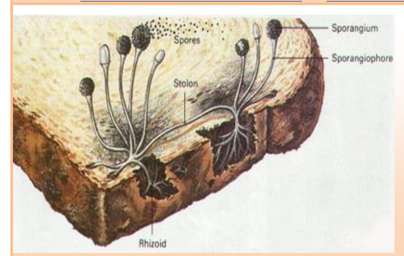
(2N). Because it reproduce asexual by Regeneration by mitotic division

4 -Spore propagation

It occurs in

Spore propagation It Is a type of asexual reproduction occur in fungus and by producing spores

1-Some fungi such as ***bread mould -mushrooms.***





2-Some Algae



How does the reproduction by Spore propagation occur?

1- Each sporangium (special organs) has a large number of spores that release after rupturing its wall.

2-When spores find a suitable environment, they starts growing to gives out a new organism.

What each spore cell will give if it placed on wet bred again? New fungus

What is the type of cell division in this reproduction? Mitotic

5 -Vegetative propagation

Vegetative propagation -Plants reproduce vegetative without needing seeds by the plant's vegetative organs (leaves- stems – roots)



Artificially - *The cells (tissues culturing) in order to produce new plants very similar to the parent plant.*

Naturally - *by the plant's vegetative organs (leaves- stems – roots) cell's mitotic division.*

Information

1-Asexual reproduction produces individuals identical in genetic structure the original organism.

2-The similarity in the genetic structure of the resulted offspring is caused by (mitosis).

3-The new offspring gets a full copy of the parental individual's genetic traits.

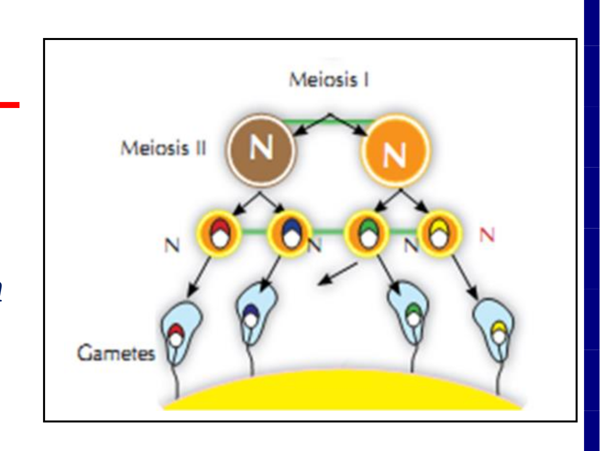
Thus, no genetic variations occurred causing difference in the resulting offspring from the original organism.

Second: Sexual reproduction

- *It is the most common type of reproduction especially in the higher living organisms.*

Sexual reproduction occurs between two parental individuals. One of them is a male and the other is a female. Sexual reproduction depends on two main processes: formation of gametes and fertilization.

Formation of gametes



1-Gametes cells known as reproductive cells

2- It produces by the meiotic division (reduction division).

3-Gametes resulted from this division contain half the number of chromosomes (N) in organism's somatic cells.

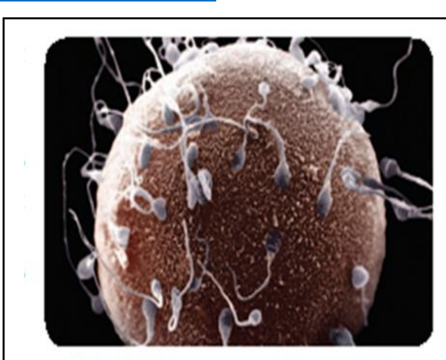
Fertilization

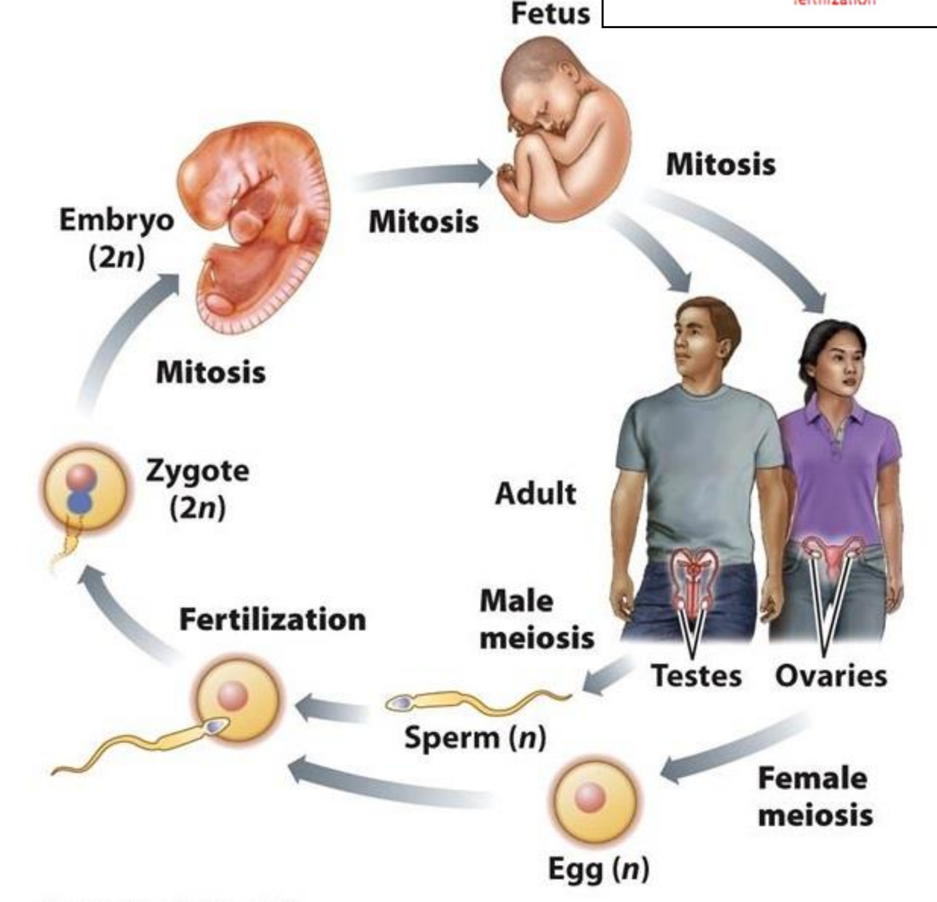
Fertilization - It is the combination of a male gamete (N) and a female gamete(N) to form a zygote which contains the normal number of chromosomes of the organism.

This zygote *contains genetic material from each parent.*
When it grows *it gives a new offspring whose traits combine each parent's traits.*

Sexual reproduction is a source of genetic variation:

-The offspring resulting *from sexual reproduction combines the genetic traits from two sources one of them is the **male** parent and the other is the **female** parent.*
-This means that *the resulted offspring have new genetic traits that combine the parent's traits.*
Sexual reproduction *is a source of genetic variation.*


Fig (20): Sperms surround the ovum before fertilization



Unit four Lesson two

1- Choose the correct answer:

1. Through reproduction process………………. Transfer from parents to their offspring.
a. genetic traits b. organs c. gametes d. hormones

2. …………………..reproduction mostly occurs in single-celled living organisms
a. Sexual b. Asexual c. Mitotic d. (a) and (b)

3. Asexual reproduction takes place by… ………. division
a. meiotic b. reduction c. mitotic. d. (a) and (b)

4. Bacteria reproduce by
a sexual.. b. spores c. vegetative d. binary fission.

5. Binary fission, budding, spore propagation and regeneration take place by ……..
a. mitosis. b. meiosis c. fission d. sexual.

6. The binary fission of asexual reproduction occurs in ..
a, mammals, b. euglena c. reptiles d. the flowering plants.

7. Asexual reproduction occurs in the yeast fungus by
a. budding b. Sporogony. c. regeneration. d. binary fission.

8. Amoeba reproduce by
a. binary fission b. gametes. c regeneration. d. budding

9. The reproduction by budding occurs in
a. mushroom. c. bread mould fungus c. yeast fungus d. bacteria.

10. The parental individual disappears when the reproduction occurs in the
a. bacteria b. yeast. c. bread mould fungus. d.. d mushroom

11. The parental individual disappear during reproduction by
a. sporangium. . b. regeneration. c. binary fission. d. budding.

12. Asexual reproduction in hydra occurs by
a. regeneration b. budding c. spore formation d. cutting.

13. The ability of some animals to compensate their missing parts is called . ……
a. budding. b. sporangium. C. sexual reproduction. d. regeneration.

14. The unicellular protozoans such as amoeba and paramecium reproduce by ……
a. binary fission b. budding c. regeneration d. spores

15.A colony of yeast may be formed as a result of
a budding. b. mitosis. c. regeneration d. (a) & (b) are correct

16. The type of asexual reproduction that occurs in some fungi and algue is the …..
a. regeneration. b. spore propagation.
c. budding. d. vegetative reproduction

17. Starfish reproduces asexually by
a regeneration. . b. binary fission c. budding. d. spores

18. If the chromosomal number in cells of starfish is (2N), the number of chromosomes in resulted cells is
a. N b. 2N c. ½N . d. no correct answer,

19. Starfish arms could be regenerated and give a new animal if they contain a part of the
a. bud. b. zygote c. sporangium d. central disc... ()

20. Bread mould fungus reproduces asexually by ...

a. Sporogony b. spore propagation. c. binary fission. d. regeneration.

21. Reproduction by spores occurs in all of the following organisms except ...

a. starfish b. algae. c. bread mould d. mushroom

22. Asexual reproduction by spore propagation in fungi and algae occur by producing

a. spores. b. suckers. c. cilia d. whips (Behira 2018) (Red Sea 2019)

23. The reproduction by spores occur in this living organisms, except

a. amoeba. b. bread mould fungus.

c. mushroom. d. no correct answer.

24. In the vegetative reproduction, the produced individuals are similar to their.. .....

a. parent individual. b. both parents. c. the zygote d. no correct answer.

25. Spores are formed in some fungi inside a structure called ....

a. bud b. zygote. c . sporangium d. central disc.

26. The vegetative reproduction occurs in plants without need of ....

a. stems. b. seeds. c. leaves. d. roots. (Ismailia 2017/ Matrouh 2018

27. The process by which the living organism produces new individuals with genetic properties similar (identical) to the parent individual is called.............

a. sexual reproduction. b. asexual reproduction

c. vegetative reproduction. d. (b) and (c)..

28. It is possible to produce new plants identical to the mother plant by ....

a. forming gametes b. fertilization. c. budding. d. tissue culture.

29. Sexual reproduction occurs in ....

a. unicellular organisms. b. higher plants and animals.

c. plants only. d. single-celled organisms.

30. In sexual reproduction, the male gamete fuses with female gamete to form. .....

a. the sporangium. b. the zygote. . c the nucleus d. the cytoplasm.

31. Gametes formation takes place in ....

a. asexual reproduction. b. sexual reproduction. c. regeneration d. budding.

32. The type of reproduction that occurs between two individuals is. ....

a. asexual. b. sexual. c. regeneration d. binary fission.

33. ....contains genetic material from both parents and grows to form an individual carries characters from both parents.

a. The gamete b. The zygote c. The cytoplasm d. The chromosome

34. All the following cells contain full copy of genetic material except

a. spore b. bud. c. zygote. d. pollen grains

35. The source of genetic variation is the .... reproduction.

a. budding b. vegetative c. sexual d. regeneration

2. Choose from columns (B) & (C) what suits it in column (A)

1

(A)	(B)	(C)
1. Asexual reproduction	*a. occurs in unicellular living organisms*	*A. as bacteria and amoeba*
2. Sexual reproduction	*b. occurs in multicellular living organisms*	*B. as yeast fungus and hydra.*
3. Reproduction by binary fission	*c. occurs in higher living organisms*	*C. as human and flowering plants*
	d. occurs in unicellular and multicellular living organisms	*. D. as mushroom fungus*

2

(A)	(B)	(C)
1. Euglena	*a. A higher animal*	*A. Reproduces by binary fission*
2. Sponge	*b. A fungus*	*B. Reproduces by spores*
3. Mushroom	*c. A multicellular organism*	*C. Reproduces by budding*
	d. A unicellular protozoan	*D. Reproduces sexually*

3. Put (√) or (x) in front of the following statements and correct the false ones:

1. Respiration process is a process of producing new individuals of the same kind( )
2. The types of reproduction are meiosis and mitosis. ( )
3. Asexual reproduction occurs by only one living organism. ( ) (Qena 2014)
4. The unicellular protozoans reproduce by binary fission. ( )
5. Simple algae are divided by binary fission ( )
6. D Sexual reproduction maintains the genetic structure of the living organisms( )
7. D Amoeba is divided by the binary fission into two identical cells. each is similar the parental cell. ( )
8. A bud emerges as a lateral bulge in the cell, then the cell nucleus divides meiotically into two nuclei, one of them remains in the parental cell and the other one immigrates to the bud. ( )
9. The starfish reproduces by regeneration. ( )
10. Yeast reproduces asexually by binary fission. ( )
11. Asexual reproduction of living organisms occurs mitotically. ( )
12. Asexual reproduction keeps the genetic structure of living organisms. ( )
13. The offspring resulted from the asexual reproduction has traits different from the original organism. ( )
14. The gametes are often (2N), while somatic cells are often (N). ( )
15. Sexual reproduction takes place by gametes which are produced through mitosis. ( )

4. Correct the underlined words:

1. Euglena reproduces asexually by budding.
2. Euglena reproduces asexually by budding.
3. Yeast fungus reproduces asexually by regeneration.
4. The starfish reproduces by binary fission.
5. The binary fission is considered as meiotic division.
6. Amoeba is divided by the budding into two identical cells, each cell is similar to the parental cell.
7. Reproduction by spore propagation occurs in paramecium.
8. The reproduction by budding occurs in the unicellular living organisms only.
9. From unicellular living organisms that reproduces by budding is hydra.
10. The parent individual disappears during the reproduction by sporogony.
11. Asexual reproduction is a source of genetic variation.
12. The sexual reproduction depends on two main processes which are crossing and fertilization.
13. Sexual reproduction takes place in plants by spores.
14. Reproduction by sporogony occurs in starfish.
15. To produce new plants identical to the original ones, the method of cultivating seeds is used.
16. The zygote contains the half number of chromosomes present in the somatic cells of living organism.
17. Gamete contain diploid number of chromosomes.
18.The fertilized ovum is called the ovary.
19. Pollination is the combination of the female gamete and male gamete to form a zygote. (New Valley 2019) (Menia 2019
20. The cell produced due to fertilization is called tetrad.
21. In sexual reproduction, the male gamete fuses with female gamete to form sporangium

5. Write the scientific term of each of the following:

1. A biological process, where the living organisms produce new individuals of the same kind to ensure their continuity.
• The ability of living organisms to produce new individuals.
2. A process in which living organisms produce new individuals with genetic traits identical to those of their parents.
The type of reproduction that takes place by only one living organism.
3. A type of asexual reproduction occurs in unicellular living organisms.
•A type of asexual reproduction in which the nucleus divides mitotically (mitosis) and then the cell which represents the body of the unicellular organism splits into two cells.
4. The type of asexual reproduction in which a colony may be formed.

5. A structure emerges as a lateral bulge from the mother's cell and contains a nucleus.
6. The ability of some animals to compensate their missing parts. (
7. The ability of the missing part in some living organisms to grow forming complete organism.
8. An animal consists of a central disc from which many arms arise.
9. Special organs inside which a large number of spores are found.
10. Special organs for reproduction in algae and fungi.
11. The type of asexual reproduction occurs in yeast fungus and sponges.
12. The most common asexual reproduction in fungi and algae.
13. Asexual reproduction takes place in some plants without needing seeds that is by their vegetative organs.
14. The type of reproduction in which no genetic variation takes place.
15. A process by which the living organism produces individuals with traits differ from
*. * The type of reproduction which is considered as a source of genetic variation.*
** The type of reproduction that occurs in higher multicellular organisms.*
16. A process in which the fusion (combination) takes place between a male gamete and a female gamete to form a zygote.
17. Cells produced in higher living organisms from special cells known as reproductive cells through meiosis.
18. Cells are specialized for forming gametes. (Qna. Faryoum 2019
19.It is resulted from the combination of a male gamete and a female gamete d . contains the diploid number of chromosomes (2N) of the living organism (
20 • It is a cell produced due to fertilization and it contains the complete number e chromosomes of the living organism.
• It contains genetic material from both parent and during growth it gives new individual carries the traits of both parents.

6. Give reasons for:

1. Reproduction is the way of living organisms to ensure the continuity of their species
2. All types of asexual reproduction take place by only one individual.
3. Asexual reproduction needs neither special systems nor structures to occur.
*4. * Asexual reproduction keeps the genetic structure of the living organism.*
**Asexual reproduction produces offspring with genetic traits identical to those of their parent*
5. Asexual reproduction depends on the mitotic division.
6. Binary fission is considered as mitotic division.
7. The genetic material is doubled before the binary fission of the bacterial cell.
8. The parent cell which reproduces by binary fission disappears.
9. A colony may be formed through reproduction by budding.
10. Starfish continues alive even a part of its body is cut.

11. Starfish reproduces asexually by regeneration.
12. The number of chromosomes in cells resulted by regeneration is (2N) as in the parental cell
13. Vegetative reproduction is called by this name.
14. Asexual reproduction in plants does not need the presence of gametes.
15. There are no new races (new individual with other trait) of plants (like grape), when they reproduce by vegetative reproduction.
16. Spore propagation is a type of asexual reproduction which is common in some fungi such as bread mould and mushroom.
17. The sporangium of bread mould fungus must be ruptured during reproduction.
18. Sexual reproduction depends on the meiotic division.
19. The zygote has the same number of chromosomes of cells of parental organisms.
20. The number of chromosomes is constant in the same species which reproduce sexually
21. Sexual reproduction is a source of the genetic variation between individuals.

7. Mention the importance or role of:

1. The reproduction process.
2. Asexual reproduction in producing offspring identical to their parents.
3. The central disc in the starfish.
4. Sporangium.
5. Vegetative reproduction.
6. The sexual reproduction in the occurrence of the genetic Variation.
7. Fertilization process.
8. Zygote.

8. Mention an example of:

1 A unicellular protozoan reproduces by binary fission.
2. A unicellular organism reproduces by budding.
3. An animal reproduces by regeneration.
4. An organism reproduces by spores.
5. A living organism reproduces sexually by two parents.

9. Compare between each pair of the following:

1. Asexual reproduction and sexual reproduction in view of each of the following:
a. Number of parents.
b. The genetic traits in the resulted offspring.
c. The type of cell division involved.
2. Reproduction by budding and reproduction by regeneration.
3. Reproduction by budding and reproduction by Sporogony.
4. Amoeba and yeast fungus according to the type of asexual reproduction
5. Pollen grain and sperm (according to site of formation).
6. Gametes and zygote.